G05B  CONTROL OR REGULATING SYSTEMS IN GENERAL; FUNCTIONAL ELEMENTS OF SUCH SYSTEMS; MONITORING OR TESTING ARRANGEMENTS FOR SUCH SYSTEMS OR ELEMENTS (fluid-pressure actuators or systems acting by means of fluids in general F15B; valves per se F16K; characterised by mechanical features only G05G; sensitive elements, see the appropriate subclass, e.g. G12B, subclass of G01, H01; correcting units, see the appropriate subclass, e.g. H02K)

NOTES
1. This subclass covers features of control systems or elements for regulating specific variables, which are clearly more generally applicable.
2. This subclass does not cover:
   a. systems for controlling or regulating non-electric variables in general, which are covered by subclass G05D;
   b. systems for regulating electric or magnetic variables in general, which are covered by subclass G05F;
   c. systems specially adapted for the control of particular machines or apparatus provided for in a single other subclass, which are classified in the relevant subclass for such machines or apparatus, provided that there is specific provision for control or regulation relevant to the special adaptation. Otherwise, classification is made in the most appropriate place in this subclass.
3. In this subclass, the following terms or expressions are used with the meanings indicated:
   • "automatic controller" means a system, circuit, or device in which a signal from the detecting element is compared with a signal representing the desired value and which operates in such a way as to reduce the deviation. The automatic controller generally does not include the sensitive element, i.e. that element which measures the value of the condition to be corrected, or the correcting element, i.e. that element which adjusts the condition to be corrected;
   • "electric" includes "electromechanical", "electrohydraulic" or "electropneumatic".
4. In this subclass, details or specific control systems are classified in the group relevant to that system, if not otherwise provided for.

WARNING
In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

1/00 Comparing elements, i.e. elements for effecting comparison directly or indirectly between a desired value and existing or anticipated values (comparing phase or frequency of two electric signals H03D 13/00)
   1/01 . electric
   1/02 . . for comparing analogue signals
   1/022 . . . [using discharge tubes]
   1/025 . . . [using inductance means]
   1/027 . . . [using impedance bridges]
   1/03 . . for comparing digital signals
   1/04 . . . with sensing of the position of the pointer of a measuring instrument
   1/06 . . . continuous sensing
   1/08 . . . stepwise sensing
   1/11 . fluidic
   5/00 Anti-hunting arrangements
   5/01 . electric
   5/04 . fluidic
   6/00 Internal feedback arrangements for obtaining particular characteristics, e.g. proportional, integral, differential (in automatic controllers G05B 11/00)
   6/01 . electric
   6/05 . fluidic
   7/00 Arrangements for obtaining smooth engagement or disengagement of automatic control
   7/02 . electric
   7/04 . fluidic
   9/00 Safety arrangements (G05B 7/00 takes precedence; safety arrangements in programme-control systems G05B 19/048, G05B 19/406; safety valves F16K 17/00; emergency protective circuit arrangements in general H02H)
   9/02 . electric
Automatic controllers (G05B 13/00 takes precedence)

11/00

11/01 . . . electric
11/011 . . . {details of the correcting means}
11/012 . . . {details of the transmission means}
11/013 . . . {using discharge tubes}
11/015 . . . {using rotating amplifiers}
11/016 . . . {using inductance means}
11/017 . . . {using photo-electric means}
11/018 . . . {using thermal amplifiers}
11/06 . . . in which the output signal represents a continuous function of the deviation from the desired value, i.e. continuous controllers (G05B 11/26 takes precedence)
11/10 . . . the signal transmitted being dc
11/12 . . . the signal transmitted being modulated on an ac carrier
11/14 . . . in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers (G05B 11/26 takes precedence)
11/16 . . . Two-step controllers, e.g. with on-off action
11/18 . . . Multi-step controllers
11/26 . . . in which the output signal is a pulse-train
11/28 . . . using pulse-height modulation; using pulse-width modulation
11/30 . . . using pulse-frequency modulation
11/32 . . . with inputs from more than one sensing element; with outputs to more than one correcting element
11/36 . . . with provision for obtaining particular characteristics, e.g. proportional, integral, differential
11/38 . . . for obtaining a proportional characteristic
11/40 . . . for obtaining an integral characteristic
11/42 . . . for obtaining a characteristic which is both proportional and time-dependent, e.g. P.I., P.I.D.
11/44 . . . pneumatic only
11/46 . . . without auxiliary power
11/48 . . . with auxiliary power
11/50 . . . in which the output signal represents a continuous function of the deviation from the desired value, i.e. continuous controllers
11/52 . . . in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers
11/54 . . . Two-step controllers, e.g. with on-off action
11/56 . . . Multi-step controllers
11/58 . . . with inputs from more than one sensing element; with outputs to more than one correcting element
11/60 . . . hydraulic only

13/00 Adaptive control systems, i.e. systems automatically adjusting themselves to have a performance which is optimum according to some preassigned criterion (G05B 19/00 takes precedence; machine learning G06N 20/00)

13/02 . . . electric
13/0205 . . . {not using a model or a simulator of the controlled system}
19/040 . . . [Programme-control specially adapted for machine tool control and not otherwise provided for (B23Q takes precedence; G05B 19/06 - G05B 19/16 take precedence)]
19/041 . . . . . [Function-oriented details]
19/0415 . . . . . [adapting phase duration according to measured parameters]
19/042 . . . using digital processors (G05B 19/05 takes precedence)
19/0421 . . . . . [Multiprocessor system]
19/0423 . . . . . [Input/output]
19/0425 . . . . . . [Safety, monitoring]
19/0426 . . . . . . [Programming the control sequence]
19/0428 . . . . . . [Safety, monitoring (G05B 19/0423 takes precedence)]
19/045 . . . . . using logic state machines, consisting only of a memory or a programmable logic device containing the logic for the controlled machine and in which the state of its outputs is dependent on the state of its inputs or part of its own output states, e.g. binary decision controllers, finite state controllers
19/048 . . . Monitoring; Safety
19/05 . . . Programmable logic controllers, e.g. simulating logic interconnections of signals according to ladder diagrams or function charts
19/052 . . . . . [Linking several PLCs]
19/054 . . . . . [Input/output]
19/056 . . . . . . [Programming the PLC]
19/058 . . . . . . . [Safety, monitoring]
19/06 . . . using cams, discs, rods, drums, or the like (mechanical programme-control apparatus G05G 21/00)
19/063 . . . . . [for sequential programme-control without delivering a reference value]
19/066 . . . . . . [for delivering “step function”, a slope function or a continuous function]
19/07 . . . where the programme is defined in the fixed connection of electrical elements, e.g. potentiometers, counters, transistors
19/075 . . . . . . [for delivering a step function, a slope or a continuous function (G05B 19/06 takes precedence; function generators per se H03K, G06G)]
19/08 . . . using plugboards, cross-bar distributors, matrix switches, or the like
19/10 . . . using selector switches
19/102 . . . . . [for input of programme steps, i.e. setting up sequence]
19/104 . . . . . . [characterised by physical layout of switches; switches co-operating with display; use of switches in a special way]
19/106 . . . . . . . [for selecting a programme, variable or parameter]
19/108 . . . . . . . . [characterised by physical layout of switches; switches co-operating with display; use of switches in a special way]
19/12 . . . using record carriers
19/122 . . . . . . [using cards, tapes or discs having conductive paths (G05B 19/128 takes precedence)]
19/124 . . . . . . [using tapes, cards or discs with optically sensed marks or codes (G05B 19/128, G05B 19/14 take precedence)]
19/126 . . . . . . [using cards, tapes or discs having protuberances (G05B 19/128 takes precedence)]
19/128 . . . . . . [the workpiece itself serves as a record carrier, e.g. by its form, by marks or codes on it]
19/14 . . . . . . . using punched cards or tapes ((G05B 19/128 takes precedence)]
19/16 . . . . . . . using magnetic record carriers ((G05B 19/128 takes precedence)]
19/18 . . . Numerical control [NC], i.e. automatically operating machines, in particular machine tools, e.g. in a manufacturing environment, so as to execute positioning, movement or co-ordinated operations by means of programme data in numerical form (G05B 19/418 takes precedence)
19/182 . . . . . [characterised by the machine tool function, e.g. thread cutting, cam making, tool direction control (G05B 19/21 - G05B 19/40 take precedence)]
19/184 . . . . . . [Generation of cam-like surfaces]
19/186 . . . . . . [Generation of screw- or gearlike surfaces]
19/188 . . . . . . [characterised by special applications and not provided for in the relevant subclasses, (e.g. making dies, filament winding)]
19/19 . . . . . . . characterised by positioning or contouring control systems, e.g. to control position from one programmed point to another or to control movement along a programmed continuous path

NOTE
In this group, the measuring system for an axis is used to measure the displacement along that axis. This measurement is used as position-feedback in the servo-control system.

19/195 . . . . . . . (Controlling the position of several slides on one axis]
19/21 . . . . . . . using an incremental digital measuring device
19/23 . . . . . . . for point-to-point control
19/231 . . . . . . . . . . [the positional error is used to control continuously the servomotor according to its magnitude]
19/232 . . . . . . . . . . [with speed feedback only]
19/234 . . . . . . . . . . [with current or torque feedback only]
19/235 . . . . . . . . . . . [with force or acceleration feedback only]
19/237 . . . . . . . . . . . . [with a combination of feedback covered by G05B 19/232 - G05B 19/235]
19/238 . . . . . . . . . . . . . [the positional error is only used to control speed in steps according to distance left, or to give a stop signal when error reaches zero]
19/25 . . . . . . . for continuous-path control
19/251 . . . . . . . . . . . [the positional error is used to control continuously the servomotor according to its magnitude]
19/253 . . . . . . . . . . . [with speed feedback only]
19/255 . . . . . . . . . . . . [with current or torque feedback only]
characterised by control arrangements for positioning, e.g. centring a tool relative to a hole in the workpiece, additional detection means to correct position (G05B 19/19 takes precedence)

characterised by control arrangements for compensation, e.g. for backlash, overshoot, tool offset, tool wear, temperature, machine construction errors, load, inertia (G05B 19/19, G05B 19/41 take precedence)

characterised by monitoring or safety (G05B 19/19 takes precedence)

Avoiding collision or forbidden zones

Monitoring servoloop, e.g. overload of servomotor, loss of feedback or reference

Monitoring general control system (G05B 19/4062 takes precedence)

Monitoring tool breakage, life or condition

Restoring data or position after power failure or other interruption

Verifying part programme on screen, by drawing or other means

Simulating machining process on screen (G05B 19/4068 takes precedence)

characterised by data handling or data format, e.g. reading, buffering or conversion of data

Adapting programme, configuration

Coordinate conversions; Other special calculations

characterised by using manual input [MDI] or by using control panel, e.g. controlling functions with the panel; characterised by control panel details, by setting parameters (G05B 19/408, G05B 19/4093 take precedence)

characterised by part programming, e.g. entry of geometrical information as taken from a technical drawing, combining this with machining and material information to obtain control information, named part programme, for the NC machine

[concerning programming of geometry]

[Shape input]

[Selecting figure elements from a menu table]

[Selection of predetermined shapes and defining the dimensions with parameter input]

[Defining geometry with a high level language]

[concerning programming of machining or material parameters, pocket machining]

[Tool management]

characterised by using design data to control NC machines, e.g. CAD/CAM (G05B 19/4093 takes precedence; CAD in general G06F 30/00)

Surface or curve machining, making 3D objects, e.g. desktop manufacturing

characterised by interpolation, e.g. the computation of intermediate points between programmed end points to define the path to be followed and the rate of travel along that path (G05B 19/25, G05B 19/31, G05B 19/37, G05B 19/39, G05B 19/40 take precedence)

[with force or acceleration feedback only]

[with a combination of feedback covered by G05B 19/253 - G05B 19/256]

using an absolute digital measuring device

for point-to-point control

{the positional error is used to control continuously the servomotor according to its magnitude}

{with speed feedback only}

{with current or torque feedback only}

{with force or acceleration feedback only}

{with a combination of feedback covered by G05B 19/293 - G05B 19/296}

for continuous-path control

{the positional error is used to control continuously the servomotor according to its magnitude}

{with speed feedback only}

{with current or torque feedback only}

{with force or acceleration feedback only}

{with a combination of feedback covered by G05B 19/313 - G05B 19/316}

using an analogue measuring device

for point-to-point control

{the positional error is used to control continuously the servomotor according to its magnitude}

{with speed feedback only}

{with current or torque feedback only}

{with force or acceleration feedback only}

{with a combination of feedback covered by G05B 19/353 - G05B 19/356}

for continuous-path control

{the positional error is used to control continuously the servomotor according to its magnitude}

{with speed feedback only}

{with current or torque feedback only}

{with force or acceleration feedback only}

{with a combination of feedback covered by G05B 19/373 - G05B 19/376}

using a combination of the means covered by at least two of the preceding sub-groups G05B 19/21, G05B 19/27, and G05B 19/33

Open loop systems, e.g. using stepping motor, characterised by control arrangements for measuring, e.g. calibration and initialisation, measuring workpiece for machining purposes (G05B 19/19 takes precedence)

[going to a reference at the beginning of machine cycle, e.g. for calibration]
19/4103 . . . . Digital interpolation
19/4105 . . . . Analog interpolation
19/414 . . . . Structure of the control system, e.g. common controller or multiprocessor systems, interface to servo, programmable interface controller
19/4141 . . . . [characterised by a controller or microprocessor per axis]
19/4142 . . . . [characterised by the use of a microprocessor (G05B 19/4141 takes precedence)]
19/4144 . . . . [characterised by using multiplexing for control system]
19/4145 . . . . [characterised by using same processor to execute programmable controller and numerical controller function [CNC] and PC controlled NC [PCNC]]
19/4147 . . . . [characterised by using a programmable interface controller [PIC]]
19/4148 . . . . [characterised by using several processors for different functions, distributed (real-time) systems (G05B 19/4141 takes precedence)]
19/4155 . . . . [characterised by programme execution, i.e. part programme or machine function execution, e.g. selection of a programme]
19/416 . . . . [characterised by control of velocity, acceleration or deceleration (G05B 19/19 takes precedence)]
19/4163 . . . . [Adaptive control of feed or cutting velocity (without NC B23Q 15/12)]
19/4166 . . . . [Controlling feed or in-feed (G05B 19/4163 takes precedence)]
19/418 . . . . Total factory control, i.e. centrally controlling a plurality of machines, e.g. direct or distributed numerical control [DNC], flexible manufacturing systems [FMS], computer integrated manufacturing [CIM]
19/41805 . . . . [characterised by assembly]
19/4181 . . . . [characterised by direct numerical control [DNC]]
19/41815 . . . . [characterised by the cooperation between machine tools, manipulators and conveyor or other workpiece supply system, workcell]
19/4182 . . . . [manipulators and conveyor only]
19/41825 . . . . [machine tools and manipulators only, machining centre]
19/4183 . . . . [characterised by data acquisition, e.g. workpiece identification]
19/41835 . . . . [characterised by programme execution]
19/4184 . . . . [characterised by fault tolerance, reliability of production system]
19/41845 . . . . [characterised by system universality, reconfigurability, modularity]
19/4185 . . . . [characterised by the network communication]
19/41855 . . . . [by local area network [LAN], network structure]
19/4186 . . . . [by protocol, e.g. MAP, TOP]
19/41865 . . . . [characterised by job scheduling, process planning, material flow]
19/4187 . . . . [by tool management]
19/41875 . . . . [characterised by quality surveillance of production]
19/4188 . . . . [characterised by CIM planning or realisation]
19/41885 . . . . [characterised by modeling, simulation of the manufacturing system]
19/4189 . . . . [characterised by the transport system]
19/41895 . . . . [using automatic guided vehicles [AGV] (control of position or course of AGV's G05D 1/00)]
19/42 . . . . Recording and playback systems, i.e. in which the programme is recorded from a cycle of operations, e.g. the cycle of operations being manually controlled, after which this record is played back on the same machine
19/4202 . . . . [preparation of the programme medium using a drawing, a model]
19/4205 . . . . [in which a drawing is traced or scanned and corresponding data recorded]
19/4207 . . . . [in which a model is traced or scanned and corresponding data recorded]
19/421 . . . . Teaching successive positions by mechanical means, e.g. by mechanically-coupled handwheels to position tool head or end effector (G05B 19/42 takes precedence)
19/423 . . . . Teaching successive positions by walk-through, i.e. the tool head or end effector being grasped and guided directly, with or without servo-assistance, to follow a path
19/425 . . . . Teaching successive positions by numerical control, i.e. commands being entered to control the positioning servo of the tool head or end effector
19/427 . . . . Teaching successive positions by tracking the position of a joystick or handle to control the positioning servo of the tool head, master-slave control (G05B 19/423 takes precedence)
19/43 . . . . fluidic
19/44 . . . . pneumatic
19/46 . . . . hydraulic

21/00 Systems involving sampling of the variable controlled (G05B 13/00 - G05B 19/00 take precedence; transmission systems for measured values G08C; electronic switching or gating H03K 17/00)
21/02 . . . . electric

23/00 Testing or monitoring of control systems or parts thereof (monitoring of programme-control systems G05B 19/048, G05B 19/406)
23/02 . . . . Electric testing or monitoring
23/0202 . . . . [in which a transfer function of a process is calculated]

WARNING

Group G05B 23/0202 is no longer used for the classification of documents as of August 1, 2018. The content of this group is being reclassified into Group G05B 23/0205 - G05B 23/0297.

Groups G05B 23/0205 - G05B 23/0297 are incomplete pending reclassification from Group G05B 23/0202.

Groups G05B 23/0202 and G05B 23/0205 - G05B 23/0297 should be considered in order to perform a complete search.
WARNING

Groups G05B 23/0205 - G05B 23/0297 are incomplete pending reclassification of documents from group G05B 23/0202.

Groups G05B 23/0202 and G05B 23/0205 - G05B 23/0297 should be considered in order to perform a complete search.

23/0205 . . . . [by means of a monitoring system capable of detecting and responding to faults]

23/0208 . . . . [characterized by the configuration of the monitoring system]

23/021 . . . . . [adopting a different treatment of each operating region or a different mode of the monitored system, e.g. transient modes; different operating configurations of monitored system]

23/0213 . . . . [Modular or universal configuration of the monitoring system, e.g. monitoring system having modules that may be combined to build monitoring program; monitoring system that can be applied to legacy systems; adaptable monitoring system; using different communication protocols]

23/0216 . . . . [Human interface functionality, e.g. monitoring system providing help to the user in the selection of tests or in its configuration]

23/0218 . . . . [characterised by the fault detection method dealing with either existing or incipient faults]

23/0221 . . . . [Preprocessing measurements, e.g. data collection rate adjustment; Standardization of measurements; Time series or signal analysis, e.g. frequency analysis or wavelets; Trustworthiness of measurements; Indexes therefor; Measurements using easily measured parameters to estimate parameters difficult to measure; Virtual sensor creation; De-noising; Sensor fusion; Unconventional preprocessing inherently present in specific fault detection methods like PCA-based methods]

23/0224 . . . . [Process history based detection method, e.g. whereby history implies the availability of large amounts of data]

23/0227 . . . . . [Qualitative history assessment, whereby the type of data acted upon, e.g. waveforms, images or patterns, is not relevant, e.g. rule based assessment; if-then decisions]

23/0229 . . . . . [knowledge based, e.g. expert systems; genetic algorithms]

23/0232 . . . . . [based on qualitative trend analysis, e.g. system evolution]

23/0235 . . . . [based on a comparison with predetermined threshold or range, e.g. "classical methods", carried out during normal operation; threshold adaptation or choice; when or how to compare with the threshold]

23/0237 . . . . . [based on parallel systems, e.g. comparing signals produced at the same time by same type systems and detect faulty ones by noticing differences among their responses]

23/024 . . . . . [Quantitative history assessment, e.g. mathematical relationships between available data; Functions therefor; Principal component analysis [PCA]; Partial least square [PLS]; Statistical classifiers, e.g. Bayesian networks, linear regression or correlation analysis; Neural networks]

23/0243 . . . . . [model based detection method, e.g. first-principles knowledge model]

23/0245 . . . . . [based on a qualitative model, e.g. rule based; if-then decisions]

23/0248 . . . . . [Causal models, e.g. fault tree; digraphs; qualitative physics]

23/0251 . . . . . [Abstraction hierarchy, e.g. "complex systems", i.e. system is divided in subsystems, subsystems are monitored and results are combined to decide on status of whole system]

23/0254 . . . . . [based on a quantitative model, e.g. mathematical relationships between inputs and outputs; functions: observer, Kalman filter, residual calculation, Neural Networks]

23/0256 . . . . . [injecting test signals and analyzing monitored process response, e.g. injecting the test signal while interrupting the normal operation of the monitored system; superimposing the test signal onto a control signal during normal operation of the monitored system]

23/0259 . . . . . [characterized by the response to fault detection]

23/0262 . . . . . [Confirmation of fault detection, e.g. extra checks to confirm that a failure has indeed occurred]

23/0264 . . . . . [Control of logging system, e.g. decision on which data to store; time-stamping measurements]

23/0267 . . . . . [Fault communication, e.g. human machine interface [HMI]]

23/027 . . . . . [Alarm generation, e.g. communication protocol; Forms of alarm]

23/0272 . . . . . [Presentation of monitored results, e.g. selection of status reports to be displayed; Filtering information to the user]

23/0275 . . . . . [Fault isolation and identification, e.g. classify fault; estimate cause or root of failure]

23/0278 . . . . . [Qualitative, e.g. if-then rules; Fuzzy logic; Lookup tables; Symptomatic search; FMEA]

23/0281 . . . . . [Quantitative, e.g. mathematical distance; Clustering; Neural networks; Statistical analysis]

23/0283 . . . . . [Predictive maintenance, e.g. involving the monitoring of a system and, based on the monitoring results, taking decisions on the maintenance schedule of the monitored system; Estimating remaining useful life [RUL] [preventive maintenance, i.e. planning maintenance according to the available resources without monitoring the system G06Q 10/06]]
23/0286  . . .  [Modifications to the monitored process, e.g. stopping operation or adapting control]
23/0289  . . .  [Reconfiguration to prevent failure, e.g. usually as a reaction to incipient failure detection]
23/0291  . . .  [Switching into safety or degraded mode, e.g. protection and supervision after failure]
23/0294  . . .  [Optimizing process, e.g. process efficiency, product quality]
23/0297  . . .  [Reconfiguration of monitoring system, e.g. use of virtual sensors; change monitoring method as a response to monitoring results]

24/00  Open-loop automatic control systems not otherwise provided for
24/02  . electric
24/04  . fluidic
99/00  Subject matter not provided for in other groups of this subclass

2219/00  Program-control systems
2219/10  . Plc systems
2219/11  . Plc I-O input output
2219/1101  . Remote I-O
2219/1102  . Speed up I-O manipulation
2219/1103  . Special, intelligent I-O processor, also plc can only access via processor
2219/1104  . Display state of connection of I-O
2219/1105  . I-O
2219/1106  . Pneumatic, hydraulic output module connected to plc module
2219/1107  . Hardware expansion of function of plc, programmable, connected in output line
2219/1108  . Relay module
2219/1109  . Expansion, extension of I-O
2219/11101  . Verifying ram data correct, validity, reload faulty data with correct data
2219/1111  . I-O grouped on one board
2219/1112  . Bit addressing, handling
2219/1113  . Address setting
2219/1114  . Address by module name
2219/1115  . Avoid to give two different addresses to same I-O, no duplicate
2219/1116  . Position of module in loop, ring determines address of module
2219/1117  . Parallel input addressed as memory
2219/1118  . Peripherals have a key to determine kind of peripheral
2219/1119  . Key is 8-resistors connected to either 0-or-1 to form a byte key
2219/1121  . Read key multiplexed, 16-bit wide, connect some resistors to reversed potential
2219/1122  . Program address module after installation, connect programmer into module
2219/1123  . Poll and detect connected I-O addresses, not connected means high address
2219/1124  . Transfer address to module, decrement, send this as address for next module
2219/1125  . I-O addressing
2219/1126  . Conversion table between original defined module address and actual physical address
2219/1127  . Selector for I-O, multiplex for I-O
2219/1128  . Several networks linked to host computer
2219/1129  . Serial addressed modules on bus
2219/1131  . I-O connected to a bus
2219/1132  . High speed bus between plc and plc or programming device
2219/1133  . Sensor actuator, asi, bus, network
2219/1134  . Fieldbus
2219/1135  . Profibus
2219/1136  . Canbus
2219/1137  . Peer to peer communication
2219/1138  . Configuration of I-O
2219/1139  . By using software configurable circuit, integrated, pga between cpu and I-O
2219/1141  . Modify manually, using keyboard configuration of module
2219/1142  . Load in replacement I-O stored configuration
2219/1143  . Base configuration contains all I-O modules, deselect not present modules
2219/1144  . Program, program I-O module
2219/1145  . Normal scan of I-O and direct acces of some I-O independent from normal scan
2219/1146  . Scanning sequence as function of previous logic expression
2219/1147  . Variable rate of scan
2219/1148  . If I-O module cannot be scanned in time, report to controller
2219/1149  . I-O in groups, serviced according to critical inputs, tasks matched to I-O
2219/1151  . Fast scanning of I-O to put I-O status in image table
2219/1152  . I-O module delivers interrupt on event, store port and 10ms timestamp in buffer
2219/1153  . Scan only some I-O registers, use flags
2219/1154  . Reading repeatedly input state, try again
2219/1155  . Switching over from one input to another one
2219/1156  . Special latches release all simultaneously
2219/1157  . I-O used either as input or as output
2219/1158  . Control of output current
2219/1159  . Image table, memory
2219/1161  . Signal processing, detect or deliver analog signals
2219/1162  . Forcing I-O
2219/1163  . Multiplexer for analog signals
2219/1164  . Latch for output or input
2219/1165  . Disable I-O card by preventing current flow
2219/1166  . Create optimum data blocks for transmission
2219/1167  . Pulse wave output
2219/1168  . Peak amplitude for input, nul amplitude for activating output
2219/1169  . Activating output if input changes, transition input and output not yet on
2219/1171  . Detect only input variation, changing, transition state of variable
2219/1172  . Direct negation, inversion of inputsignal
2219/1173  . Activating output only if powersupply is sufficient
2219/1174  . Input activates directly output and vice versa
2219/1175  . Activating output repeatedly for guaranteed turning on of output
2219/1176  . I-O signal processing, adaption, conditioning, conversion of signal levels
2219/1177  . Insertion mistake
2219/1178  . Display states of I-O in time
Interrupt handling when slave processes data

Master-slave system

Real-time communication between PLC, Memory, Output directly send out

All PLC send their input to a common image, other PLC's are inactive

Separate synchronizing, Exchange control, I-O data to other PLC, using individually, without host

Multiprocessing, several PLC's, distributed logic control

Memory access for different processors, memory arbitration, mailbox

All processors are loaded with the same program, only part of the program is loaded

Download program code to node, I-O and execute program code

Communication, exchange of control, I-O data between different PLCs

Control exchange, I-O data to other PLC, individually, without host

Control exchange, I-O data to other PLC, using separate synchronizing, I-O isolation, optical

Control exchange data between PLC's only when other PLC's are inactive

All PLC send their input to a common image memory, output directly send out

Real-time communication between PLC, Ethernet for configuration, monitor

Master slave system

Interlock problem, avoid sending data to slave when slave processes data

Plc programming

Interrupt handling

Transfer rom content to ram, load ram from non volatile memory

Initial program load, host to controller

Programming the PLC

Subroutine

Prom burning

Program hardwired logic, pld, FPGA when out of machine, or inactive

Quicker execution of jumps when repeating same kind of operation

State machine instructions

Batch control

Using other programs, adapting program to machine, exchanging or reprogramming

Transferring ram to eprom see also PROM burning

Expanding functions of display by modular hardware

Semi automatic, manual automatic

Jump while output is disabled, or disabling output when running test instruction

Macro instructions

Conversion ladder diagram to decision system, machine code, language

Translate program in order to be used on different PLC

Convert Petri net to ladder diagram

Convert source program to intermediate program

Convert natural language, graphic to coded states, input

Convert PLC type program in PC type program for running in PC environment

Convert digital logic of hardware circuit into PLC software

Convert batch recipe into PLC program

Convert ladder to event chaining, internal state for FPGA or similar

Convert time chart to relation vector to calculate PLC I-O state as function of time

Convert PLC type program in PC type program for running in PC environment

Enter values with incremental keys

Use of touch screen

Different menus on screen, softkeys

Code wheel to enter data, push button to accept

Operator interface derived from comment label in program

Name, address duplication detection for program components, symbols

Tracing, use of dummy ladder to collect signals together in one

Tracing

Comment, message data displayed with program instructions

Print out of program, printer for program

Display ladder or logic diagram, mnemonics, switch between two display

Display logic diagram, LOP

Display statement, instruction list, IL, BL, AWL

Display as flow chart, SFC, FUP

Additional data to restore ladder diagram from machine instructions
Display status of edited program segments: inserted, deleted, replaced
Display data on chart with comment, message about type of data
Display of ladder, RLD, RLL, KOP
Display progress of program, state, highlight, colour
Display status of I-O in intelligible, easy to understand language
Display of ladder diagram
Edit by use of a ladder mask, raster, enter a symbol and select place in mask
Enter a symbol and number of times symbol to be used in ladder diagram
Place cursor, enter symbol, move cursor
Edit conversion, jump table interactively
Automatic search for unused, available address; assign to symbol
One instruction of plc generates a whole independent sequence, relay
If not able to execute instruction block, skip and execute next
Selection between sequential and conditional program
Booting
Synchronization between modules
Execute reverse sequence
Tasks for executing several programs asynchronously
Execute next step if state, control zone changes
Use of variables, symbols in instructions, to indicate mechanisms, interfaces
Program divided in operation blocks, groups, tasks each executed
Execute bit operation during instruction fetch cycle for word operation
Non time critical program by processor, time critical program by hardware
Super scalar computing
Several interacting programs, each for a separate machine, exchange of start, stop
Result of bit operation can modify or stop instruction execution
User program, then interlock program to override certain conditions
Interprete in pc a ladder diagram, use of sequence engine
Interlock conditions stored in tables
Sequence operation and interlock set programs are separated
Solving stored logic function if value is equal target value
Select between initialisation and normal control instructions sequence plc
Parallel execution of bit operations
Jumps
Rom or eprom with conditional instructions
Plc controls several machines in sequence
Priority interrupt
Separate interrupt controller for modules
Analyzing only relevant rows of ladder diagram
Skip part of expression evaluation if no influence on end result
Use of precalculated and stored values to speed up calculations
Speed up, evaluation of expressions between brackets
Using functions like arithmetic timers in program
Using a-d converter as function
PId regulator
Fuzzy control function
Function is true macro program, not subroutine, conversion to machine
Nc function to control axis, written in C or not grouped, called by name as servo
Function block, OOP, various functions
Two or more languages, ladder diagram or progression, basic program
Natural language, use simple words like move, rotate,
Logic symbols, plan lop, functional block symbols FBS, functional programming FUP
Flow diagram, sequential function chart with transitions and states SFC Grafcet
Pld programmable logic device software for plc
Expert system
Petri net
Read image of sequence ladder diagram, flow chart drawing, translate into code
Use of relative addresses for program
Optimize ladder diagram block by rearrangement of serial and parallel
Machine code, instruction for processor
Two languages, ladder diagram and machine code for processor
Decompiler, translate machine code to hll, reverse processing, easy modification
Compiler
DDE direct data exchange, DLL dynamic library linking
Flow chart program activates several ladder diagrams, each controls one machine
C language
Step language
Use of virtual, logical connections
Csl computer simulation language
Hybrid sfc for description of sequence, ladder diagram for conditions, interlock
Relay ladder diagram, RLL RLD KOP
Automatic documentation of program
Select out several languages: FBD, SFC, RLL or RLD
Select out several languages: FBD and SFC
Select control languages out of FB RLL or RLD, SFC, ST
Two or more languages mixed, RLD, SFC, FBD, IL, ST, relay ladder, function block, sequential function, instruction list, structured text mixed to form logic control program

Using audio and/or video playback

Interpreters considers hierarchy of plc in system structure for programming it

High level language HLL, structured text ST, resembles pascal

CAD, design plc system by inputting desired failure, fault behaviour

Derive sequence program from design, cad data of machine

Debugging, tracing

Manual testing

GUI graphical user interface, icon, function bloc editor, OI operator interface

Graphical input of network of symbols, simulation on screen, translate to machine

Process image blocks have a relation to software function blocks

Program using time charts

Object oriented programming

Encapsulated actuator model with standardized interface: state, action, interlock

Correction of program using grammatical error detection

Modification of program

Modification, change of program in real time

Patching rom to correct program

Inserting instructions in program

IC-memory card

Tape

Non volatile memory, no battery

Cassette

Easily exchangable rom, eprom cassette, earom

Core memory

Light pen

Remote and local programming unit, control panel

Program plc by independent build in processor

Program intelligent I-O separate from main plc

Personal computer pc

With contact pins

Voice, oral, vocal, speech announcement

Portable, detachable programming unit

Remote programming from computer

Selection out of all possible programs with switch

Pc, computer connected to plc to simulate machine

For each input corresponding delay time for output response

Functionality of a complex controlled systems, composed of sub-systems

Select next stimuli as function of input state of previous step, so useless stimuli skipped

Reiterate simulation till minimum delay stimuli, original contact state

Reiterate simulation for different conditions or subsystems

Selection of limited stimuli, inputs for simulation

With petrinets

Connect simulation card with overlay into control system, to learn programming

Pc, computer connected to plc to simulate only part of machine

Software function module for simulation

Simulation, also of test inputs

Checking validity of data

Checking program data, parity, key

On error, look in table for alternative allowed next instruction

Inhibit next step if signature fails, response different from stored response

Eeprom and software interlock, user cannot change ram data

Examine needed I-O, detect connected I-O, execute program only if proper I-O

Build in measurement processing time and input time, input time must be smaller

Protected programs, running these programs

Check if instruction for special module is valid for that module

Host and remote version of ladder program, avoid different versions

Safety, forbid dangerous instruction, instruction order while programming

On error choose another program

Plc safety

Detect direction, sign of change of signal

Independent processor, coprocessor monitors plc

Pc, personal computer monitors contact data of several plc's

On error I-O control state is substituted by actual state to continue

Alarm

Safety, monitoring in general

Plc as standalone for safety control of machine

Pc monitors plc

Manual override control, digital or analog, between plc and machine

Explosion free control, intrinsically safe

Safety integrity level, safety integrated systems, SIL, SIS

IN, dual plc worker coworker, switch, OUT persistency

Redundant processors and I-O

Dual plc's, processors and dual I-O

Triple plc's, processors and dual I-O, triple modular redundant

Triple plc's, processors and triple I-O

IN, plc and comparator, error detector, backup, standby plc, switch, update OUT

Dual IN, crosscoupled relay, dual AND, dual OUT

IN, direct link parallel to plc, AND, OUT

Dual IN, dual plc with dual OUT comparator, dual AND, dual OUT

IN, three plc and 2-out-of-3 processor voter, 2-out-of-3 output voter, OUT
2219/14024 . . . Dual IN, three plc with comparator, dual 2-out-of-3 output voter, dual OUT
2219/14025 . . . Dual IN, relay parallel to plc with comparator, dual AND, feedback OUT, dual OUT
2219/14026 . . . IN, relay, direct link parallel to plc, AND, OUT
2219/14027 . . . IN, plc and comparator, feedback OUT, OUT
2219/14028 . . . Dual IN, plc and comparator, feedback OUT, AND, OUT
2219/14029 . . . Dual IN, plc and comparator, feedback OUT, dual AND, OUT
2219/14031 . . . Dual plc, dual I-O, single actuator, crosscoupling IN and OUT
2219/14032 . . . Dual plc, dual I-O, crosscoupling analog IN of first plc to OUT of second plc
2219/14033 . . . Dual plc, dual I-O bus, dual I-O amplifier
2219/14034 . . . Quad system, dual worker coworker, output voter, switch
2219/14035 . . . Single analog I-O IN, dual signal processing, dual plc
2219/14036 . . . Detection of fault in processor
2219/14037 . . . Fault in I-O communication
2219/14038 . . . Fault in I-O racks, point level
2219/14039 . . . Fault in sensor, actuator
2219/14041 . . . Influence of execution of interrupts
2219/14042 . . . Process time
2219/14043 . . . Detection of abnormal temperature
2219/14044 . . . Operating time test for over or under conditions
2219/14045 . . . Parameter, over or under condition detection
2219/14046 . . . Current flow
2219/14047 . . . Open circuit, broken line, cable
2219/14048 . . . Short circuit
2219/14049 . . . Broken led, signalling device
2219/14051 . . . Correct polarity of supply
2219/14052 . . . Detect missing module
2219/14053 . . . Power failure, loss, abnormal battery
2219/14054 . . . Self test
2219/14055 . . . Make log, journal, history file of state changes
2219/14056 . . . Monitor only particular devices which are required for execution of process
2219/14057 . . . Compare response time, time interval with reference response time, interval
2219/14058 . . . Diagnostic, using expert, knowledge based system
2219/14059 . . . Selftest of voting, switching unit
2219/14061 . . . On-off-line diagnostic
2219/14062 . . . Diagnostic of dead state, machine does not function anymore
2219/14063 . . . Diagnostic of degrading performance
2219/14064 . . . Portable diagnostic unit, offline
2219/14065 . . . Checking step, diagnostic routine at end of each scan
2219/14066 . . . Look up table to determine particular fault conditions
2219/14067 . . . Log, history of key, input information before last fault occurred
2219/14068 . . . Compare operation time of each independent block, group with stored
2219/14069 . . . Dual watch dog, one for operating system, other for user program
2219/14071 . . . Test of equipment, system without using actual system
2219/14072 . . . Test of I-O scanner
2219/14073 . . . Real time modeling of plc behaviour, display pictogram of system
2219/14074 . . . Signature analysis, recorded states, zones are compared to actual
2219/14075 . . . Test of interface
2219/14076 . . . Test of sensor
2219/14077 . . . Detect difference in signal between identical channels, if plausible
2219/14078 . . . If fault in next cycle persists, declare channel faulty
2219/14079 . . . If signal out of range, use for next cycle previous detected signal
2219/14081 . . . Take average, mean of two valid signals of same input
2219/14082 . . . Sample input signal again to verify if signal is correct
2219/14083 . . . Derive diagnostic program from model needed for sequence program
2219/14084 . . . Remote diagnostic
2219/14085 . . . Memory testing
2219/14086 . . . Watch dog
2219/14087 . . . Selecting parameters or states to be displayed on panel, displaying states
2219/14088 . . . Display result of computation, calculation
2219/14089 . . . Display of control states on cards, by leds
2219/14091 . . . Message generation, composer from variables and states, zones
2219/14092 . . . Display menu and its code, sense code, compare with registered code
2219/14093 . . . Display matrix of relay, contact symbols, select and show time
2219/14094 . . . Display instruction with corresponding states, markers
2219/14095 . . . Library of pictures to display process, pictogram
2219/14096 . . . Voice, vocal, speech alarm
2219/14097 . . . Display of error messages
2219/14098 . . . Displaying instructions for monitoring state of machine
2219/14099 . . . What kind of fault, first fault latch indication
2219/14101 . . . Indication of status in a ready, off, running of fault state
2219/14102 . . . Fault stages, confinement, logical segregation of I-O, separate modules
2219/14103 . . . Detection on or off-line, latency from failure occurrence to fault recognition
2219/14104 . . . Fault masking, redundant module is selected, fault will not propagate
2219/14105 . . . Retry, reacquire input data and start fault sequence again
2219/14106 . . . Reconfiguration of components or graceful degradation, degrade
2219/14107 . . . Recovery, after detection or reconfiguration, effect an error eliminiat
2219/14108 . . . Restart of processing
2219/14109 . . . Repair on or off-line
2219/14111 . . . Reintegration, after correction of fault, failed module reinserted
2219/14112 . . . Diagnostic, troubleshooting
2219/14113 . . . Fault tolerant objectives for equipment, controller
2219/14114 . . . Integrity, error detector, switch off controller, fail safe
Plc structure of the system

- Initialize amount of memory space needed in partial cells, modules
- Assign functions to group of complete or configure priorities of different tasks
- Set configuration, address of connected module
- Configuration of operating system
- Set configuration, address of connected module from fixed non volatile
- Configure priorities of different tasks
- Assign functions to group of complete or partial cells, modules
- Initialize amount of memory space needed in module

- Redundancy, masking redundancy, avoid failure but no fault detection
- Restart, power up of processor, outputs are off, disabled or hold last state
- Each independent operation block, group has own restart, home position
- On the fly software replacement in case of error
- Restart
- Low impedance bus
- Structure, low pass filter, debounce input, output driver with ramp
- Galvanic isolation
- Plc structure of the system
- Local remote switch control
- Image table in I-O expansion module
- Interbus-s
- Identity kind of module, control unit connected
- Set switches defining control function
- From master control station
- On reinsertion board, power up, program setting, configuration automatically set
- Identify connected I-O and store in address table
- Object oriented configuring, graphical display of plant
- Configuration of operating system
- Configuration software for networks
- Set configuration, address of connected module from fixed non volatile
- Configure priorities of different tasks
- Assign functions to group of complete or partial cells, modules
- Initialize amount of memory space needed in module

- Optical fiber
- Communication, serial data transmission, modem
- RS232 serial
- Convertor between plc and pc built into serial communication line
- Synchronous serial datatransmission
- Data packet, each module reads input stream and replaces with output
- RS422, balanced lines, xor, only one transmitter, receiver, RS485
- Before starting communication between modules, initialize modules
- Detection of data transmission faults
- RS485, MPI multipoint interface, multiple transmitters, receivers connected
- Controller and device have several formats and protocols, select common one
- I-O communicates with local bus at one end and with fieldbus at other end
- RS485 for service connection to module
- Exchange objects having I-O, configuration, status, parameters, functions attributes
- Exchange objects between cpu and intelligent I-O, stored in their memory
- Serial transmission using one line for data and one line for clock
- Select between simplex, only reading I-O data or duplex, also writing to interface
- Control words for interface itself and for connected I-O
- Fail safe communication
- Internet, tcp-ip, web server see under
- Display of reference, set value, of measured, feedback value
- Sense area of screen, compare if corresponds with correct area
- Synoptic display of process, mimic diagram
- Lcd, 7-segment displays ten different states
- Multiple lcd, alphanumeric display
- Portable display unit
- Low-high intensity display, flashing
- Colour display
- Microprocessor
- Timer, counter, clock-calendar, flip-flop as peripheral
- Dual port memory
- Communication processor, link interface
- Microcontroller
- LIFO for storing intermediate results
- FIFO
- DMA
- FPGA field programmable gate array
- Tristate interface
- Floating point coprocessor
- RISC processor for plc
- Battery backup
- Real time clock
- MMU, memory management unit
- Optimize program memory space
- Use of external memory
- Using a mixture of memories
with special key

Two cpu control plc, select cpu, video switch, special communication protocol

Intelligent interface behaves like a plc, by plcs

Intelligent I-O is a plc itself, with limited functions

Linesolver, columnsolver

High speed limited function sub plc together with slow speed general

Intelligent I-O is a plc itself, with limited interface

Intelligent interface is much faster than main plc

Intelligent interface behaves like a plc, by special communication protocol

Two cpu control plc, select cpu, video switch, with special key

Common display, monitor for two controlling cpu

Coprocessor connected to main via bus and separate channel

Pc serves as plc, programming panel, monitoring panel

Pc implements plc, in application program, plc instruction register

Radio link, wireless

Shared memory

Backplane controller

Plc build into application, like power inverter

Less frequent used subroutines arranged at high addresses

Plc with build in console, I-O and communication

Plc integrated in plug, connector

Multiple kernels

Calculate duration of cycle

Bit and word, byte oriented instructions, boolean and arithmetic operations

Ternary logic instead of binary

Separating address and databus

Pipeline registers

Bank switching

Opto isolation, optical separation

Pc to applications

Nuclear plant

Transfer line

Domotique, domestic, home control, automation, smart, intelligent house

Pc systems

Pc I-O input output

Analog input

Neural classifier for inputs, groups inputs into classes

Proximity switch as input

Microprocessor plus electromechanical, cam control for output

Several slave modules connected to same I-O of master, multiplexed by master

Detect position switches, connect resistances, analog value gives position

A processor to evaluate signals of detector only, I-O processor

Read in analog values by microprocessor, potentiometer, resistor taps

Display states of I-O

Forcing I-O

Configurable I-O

Microcontroller and power output switches integrated on same chip

Interface, module with relays

Easy expansion, extension of I-O

I-O has own power supply

Use of stack memory between processor and machine

Connect sensors to a concentrator, concentrators to bus

Split, separate urgent from non urgent, interrupt from status inputs, store in two register

Intelligent I-O, executes tasks independently from main cpu
2219/21022 . . . Telephone ring interface, detect ring sequence to control devices
2219/21023 . . . Midi interface
2219/21024 . . . Analog output
2219/21025 . . . To address single module, assign a group with only that single module
2219/21026 . . . Indirect addressing of I-O through a control register
2219/21027 . . . Address extension, module with several I-O, command has subaddress for each I-O
2219/21028 . . . Address of module determined by position
2219/21029 . . . Address of module determined by function of module
2219/21031 . . . Address of module determined by signature: type, value of measured, controlled data of module
2219/21032 . . . Controlled module in a ring, each module detects its own address
2219/21033 . . . Serial transfer address to each module, decrement, if zero module found
2219/21034 . . . Address I-O
2219/21035 . . . Identification with serial header
2219/21036 . . . Each connected module has own address and address of originator of message
2219/21037 . . . Serial time multiplex bus, programming each module with one delayed line TDM
2219/21038 . . . Special clock line, module counts clock until equal to its address
2219/21039 . . . Slaves, modules in daisy chain, each handles control data, transmits to next
2219/21041 . . . Detect length of packet of pulses to recognise address
2219/21042 . . . Address a group, a zone
2219/21043 . . . Device address and subdevice address and function address
2219/21044 . . . Modules with same address are each selected by different transmission speed
2219/21045 . . . Modules with same address are each selected by different modulation
2219/21046 . . . Address a single module out of a group
2219/21047 . . . Select module if address of module equals required address, compare addresses
2219/21048 . . . Compare fixed address of module to required address
2219/21049 . . . Poll and detect connected I-O modules, address terminator, address line high
2219/21051 . . . Modules able to communicate to other modules are connected to arbitrator
2219/21052 . . . Modules having a common function are allocated ascending number to address
2219/21053 . . . Each unit, module has unique identification code, set during manufacturing, IMAC address
2219/21054 . . . Connector on bus has two rows of contacts, if one contact is connected, other not
2219/21055 . . . Number of halfwaves equals number of I-O, send block of halfwaves, synchro gap
2219/21056 . . . Decoding on module, module can be inserted anywhere, fixed address in bus connector
2219/21057 . . . Buslines connecting modules are offset by one line from module to module
2219/21058 . . . Find address by activating power and detect which address gives feedback
2219/21059 . . . I-O in address space
2219/21061 . . . Adapter bus connected to centronics

2219/21062 . . . Pc and I-O bus manager and network nodes linked to I-O clusters
2219/21063 . . . Bus, I-O connected to a bus
2219/21064 . . . Calibration: automatic of a-d convertor, store null and maximum in eeprom
2219/21065 . . . Module calibrates connected sensor
2219/21066 . . . Disconnect data line from module before, reconnect after configuration
2219/21067 . . . Set group of module by hardware for each module, no program protocol
2219/21068 . . . Configure input signals either as interrupt or status signals
2219/21069 . . . At start up check I-O and store addresses in secure device
2219/21071 . . . Configuration, each module has a settable address, code wheel, encoder
2219/21072 . . . Write, modify address into module by optical means, laser
2219/21073 . . . Each module has push button, trigger circuit to initialise address setting
2219/21074 . . . Master has keyboard to enter address of called slave
2219/21075 . . . Initialise each module random, count down, if zero master sets address
2219/21076 . . . Plug, connector with build in decoding, encoding for module
2219/21077 . . . Module address fixed, defined by fixed identification lines on motherboard
2219/21078 . . . Fixed address of slot on motherboard changed, using address convertor, decoder
2219/21079 . . . Allocate at start up also to each controlled device a code for the master
2219/21081 . . . At start up, check I-O configuration and store addresses in ram
2219/21082 . . . At start, send first address to all modules, manually trigger first module and so on
2219/21083 . . . At start up detect if connected devices are input or output devices
2219/21084 . . . Actuate module, seek response by counting up address, store address on response
2219/21085 . . . Define type of I-O, analog, digital, pulse
2219/21086 . . . Configuration menu program for I-O
2219/21087 . . . Define sensor type, resistance, thermocouple, thermistor, voltage, current
2219/21088 . . . Define name and address of I-O
2219/21089 . . . Detect configuration of I-O regular
2219/21091 . . . First module initializes its address, then signals next to do same, serial
2219/21092 . . . At start up, autoconfigure module for proper I-O execution, bootstrap
2219/21093 . . . Module has a configuration part for own logic and one for application logic
2219/21094 . . . Different connectors for serial transmission as function of machine or connected sensor
2219/21095 . . . Screen, display connected directed to control system via optical fibre
2219/21096 . . . Connection of machine to pc via centronics, parallel port
2219/21097 . . . DMA
2219/21098 . . . Connect pc to machine, controller, module via serial port
2219/21099 . . . Two independent interfaces, one for pc, other for remote monitoring
2219/21101 . . . Connect I-O interface to joystick port
Pc control of device over normal remote control connected between them

Connect pc to machine, controller, module via PCMCIA

Wire pc connector to output of controlled module, for printer, modem, other module

Read data only if value changes, transition to save processor time

If specific I-O not updated in memory, priority access of I-O, data directly to microprocessor

Change sensitivity of detection if input value is very low

Module, I-O module consisting of counters and comparators

Field programmable gate array, fpga as I-O module

Each module has a push button to bypass control and switch module on

Each module has push button to turn module off

Bus interface has multiplexer, control register, data shift register

Universal input, AC or DC

Same connector can represent either input or output

Universal cabling; control interface between processor and devices

Universal I-O, same pin is input or output, bidirectional

Two sensors on same line, superpose pulsed digital on analog signal

Circuit for signal adaption, voltage level shift, filter noise

Output only enabled during a short period of positivegoing power supply

Programmable signal discrimination, input can be used for several functions

Impedance matching

A-d conversion if input signal is analog, no a-d conversion if input signal is digital

Digital value of analog signals depends on range between signal and threshold

Signal processing, filter input

Signal adaption I-O

Change control signal, first max or min signal, then normal desired signal

Low pass filter for input

Sample two input values, one in positive wave, other in negative wave, average

Window for signal

Module to adapt connection of signals to general connector

Signal adaption circuit build into connector

On closing contact, clean contact with large current, then normal signal current

Detection of zero crossing for command and maximum for reading value

Analog to digital conversion, ADC, DAC

Variable filtering as function of kind of sensor signal

Input activates directly output and vice versa

Latched I-O

Read input signal when switching power supply is not switched

Sample analog signal between superposed digital signal

Link between input and output, output only activated if corresponding input on

Fuse in case of overcurrent

If real status is different from controlled status stop motor

Time critical I-O shut off by I-O module, otherwise by processor

Over current protection on clock line

If read write error, keep last I-O status for next cycle

Activate output only if power sufficient

If output defect, switch it off

In order to follow higher data input rate, shut off non essential peripherals

Over current protection

Over voltage protection

Over temperature protection

Broken, open line, cable, circuit, faulty connection

Activate I-O only after system stabilises from start up

If I-O defect, warning light, operator pushes button, cpu disconnects I-O

Send dummy, check data to I-O to check correct I-O connection

Detect short circuit of cable

Test I-O if functional or safe value

Resistors between transmitter and receiver, against disturbances

Zenerdiodes for protection of output of transmitter, input of receiver

Output state, over resistance, coupled back to input to monitor output

Intelligent I-O monitors also local load, controlled object

Couple, feedback each output to corresponding input to verify output

Low voltage protection

Pc multi processor system

Controller calculates a control parameter from values sent by other controllers

Grid, array of controllers

Use default values if communication with other controllers not available

Multicores

Microprocessor for display and parameter input, link to control microprocessor

Microcontroller combined with state sequencer

Each processor controls a different function of the machine

Only one processor is permitted to execute a common function at a time

Active controllers are allocated more time if request rate is low

All processors are loaded with same program, only part of program is used

Local processor uses data from own local store and data from other stations

Multicontrollers, multimicrocomputers, multiprocessing
Process directly process signals without interrupt or polling
Define module independent and module specific element, interconnection, capability
First cluster runs normal program, second cluster runs different program
Join two clusters of processors together
Processor starts application program only if it receives predetermined data
Only common memory in host, master, no local memory in slave, local controller
Use of priority levels for gaining access to resources
Use a different frequency to address each processor
Processor sends data to next, downstream processor
Communication, CPU accesses own I-O and next CPU over dual port memory
Processor accesses own I-O and I-O of all processors connected on his right
Common memory as well as local memory
Master detects and configures slaves
Multiprocessing, change over from master slave to peer to peer, no master
Master slave
Each slave can control several other slaves
Each slave can function in stand alone if master fails
Each slave has library of states during which operation is permitted to start
Master determines critical time when each of slaves must be controlled
Selection of master or slave
Several masters at same time
Reallocate, reschedule execution of controlled functions if one processor fails
Real time database, each processor stores in local memory used variables
Program references to variable by absolute address, update of absolute address
Detect incompatibilities between control devices
Pc programming
Expansion of control words, code of standard language to increase functionality
Petrinet
Bumpless control transfer, map corresponding operation states to operation tables
Build up program so that safety conditions are met, select most stable states
Expert design system, uses modeling, simulation, to control design process
Finite state modeling
CAD to develop sequential control system, use data also to test
Computer aided software engineering, program generation, case tools, CASE
Automatic documentation of program
Sequence control design using pc, cad of control system CADCS
Derive sequence program from design, cad data of machine CADCS
Build up program by selecting function modules as function of amount paid for it, charging, payment
Conversion of ASCII scripting language to machine code
Convert input signals to universal machine control signals represented by music
Accelerate input, exponent as function of pressure, time, turning speed, keys for 10-to-1
Page, scroll key
Enter parameters by combinations of keys and duration of actuation of keys
Joystick delivers reference function as function of speed of its movement, except about null
Gesture programming, camera sees hand, displays it on screen, grasp buttons
Production design metaphore, tool, operation like input system
Control knobs, levers integrated into display, display parameters near knobs
Delivers reference when in neutral position, otherwise delivers desired value
Overlay, template for keys with different meaning
Recognise user input pattern and present possible intended program
Database with information on how to control or test different appliances
Switch function of panel, detect this and execute other orders
Up down, increment decrement keys, jog, sequentially show functions or values
Simulate control panel to give remote instructions
Input of data from second control unit if first fails
Variable pressure on key gives input value
Press once on key to raise signal, twice to lower signal
Same knob, different functions, turn for pulses, push to enter value
Same knob, different function, normal for parameter, value, pushed to enter value
Touch key integrated in display
Select function by amplitude of analog value, potentiometer, resistor taps
Remote programmer
Enter analog value
Only increment key
Remote and local control panel, programming unit, switch
Transparent overlay with touch sensors, put over display panel, select function
Function key changes function as function of program, associated pictogram
Selection out of menu by function keys
Operating, repair manual stored in memory
Knob to select program serves also as indicator for progress of program
Control panel serial, RS232 connected to controller
G05B

2219/23051 . . . Remote control, enter program remote, detachable programmer
2219/23052 . . . Matrix, plugboard like control panel with modules for display, switches
2219/23053 . . . Knob with tactile feedback, representing clicks, detents programmed
2219/23054 . . . Simulate response on entered parameters and display, quicker response
2219/23055 . . . Cursor keys to select cells of a spreadsheet with control parameter, enter value
2219/23056 . . . Foot pedal, control, operated
2219/23057 . . . Position of knob, pedal detected by encoder, addresses memory for functions
2219/23058 . . . Knob, pedal selects ranges, functions and controls in each range as function of position
2219/23059 . . . Configuration of pedal, knob with code card, adapt pedal to person
2219/23061 . . . Variable range of knob, pedal for each function, adapt to person
2219/23062 . . . Position of knob, pedal detected by bundle of optical fibres
2219/23063 . . . Double, two foot pedal
2219/23064 . . . Entry of function or parameter during manipulation of tool, operation
2219/23065 . . . Manual override of program
2219/23066 . . . Same knob starts two different functions
2219/23067 . . . Control, human or man machine interface, interactive, HMI, MMI
2219/23068 . . . Give instructions, messages to operator
2219/23069 . . . Illuminated, lighting up keys, build in led, display, show sequence data entry
2219/23071 . . . If up, down key is selected, linear display of values appears, pops up
2219/23072 . . . Telephone, dialed as control panel
2219/23073 . . . Keyboard decoding by microprocessor
2219/23074 . . . Each control unit can control own associated load or as central control
2219/23075 . . . Control unit can switch load on or off can also go into program mode
2219/23076 . . . Pushbuttons to manually up or down control of motor also for entry of program
2219/23077 . . . Reconfigurable remote programmer, learn control signals for different devices
2219/23078 . . . Input a code representing a sequence of operations
2219/23079 . . . Local programmer can switch to remote to use same capabilities as remote
2219/23081 . . . MMI design, operator workplace design
2219/23082 . . . Enter parameters with two hands, dead man knob, switch, pedal
2219/23083 . . . Joystick with buttons for menu and function selection, scrolling, -sign and +sign
2219/23084 . . . Synoptic display of available, selectable control modules with their functions
2219/23085 . . . Several users can enter data simultaneously to same processor
2219/23086 . . . Menu is sequentially selected and read from cd disk and guides operator
2219/23087 . . . Programmable selector switch, can be programmed by connected apparatus
2219/23088 . . . Same switch to power control and to set references of several devices
2219/23089 . . . Key cap label rewritten, changed to indicate changed or alternate functions
2219/23091 . . . Multiple consoles, panels to issue concurrent commands to different groups I-O
2219/23092 . . . Soft up down keys, simulated on screen
2219/23093 . . . Input a code representing a device function
2219/23094 . . . Debounce key
2219/23095 . . . If knob pushed during power up, knob can be used afterwards as data input
2219/23096 . . . Use single button, knob to enter code number, equals number of pushes
2219/23097 . . . Messages to operator in mother tongue, selection out of different languages
2219/23098 . . . Manual control, via microprocessor instead of direct connection to actuators
2219/23099 . . . Switches on panel, connected to serial port
2219/23101 . . . Enter quality parameters to select control parameters
2219/23102 . . . Quality parameter is low energy consumption of machine
2219/23103 . . . Quality parameter is high production rate
2219/23104 . . . Change display of window to another as function of settable active display time of window
2219/23105 . . . Window, drop down menus
2219/23106 . . . Cockpit metaphore, condensed representation, urgent things better shown
2219/23107 . . . Push on flashing alarm indicator, corresponding window pops up on whole screen
2219/23108 . . . Floorplan, room metaphore, dedicated windows, unchangeable but can be selectable
2219/23109 . . . Configuration of display device, operator panel
2219/23111 . . . Adapt control signal logarithmic
2219/23112 . . . Ramp, slope connection between two reference values
2219/23113 . . . Reread, retransmit several times data for valid data, redundant command
2219/23114 . . . Maintain parameter setting for a while to avoid changes due to noise
2219/23115 . . . Buffer
2219/23116 . . . Input signal can be sent simultaneously to several processors
2219/23117 . . . Lookup table, interpolation between points
2219/23118 . . . Column and line select in memory to access address data in second memory, tree
2219/23119 . . . Display state, variable only when needed, energy saving
2219/23121 . . . Display graphics with corresponding text
2219/23122 . . . Display on off time chart for different events
2219/23123 . . . Production report
2219/23124 . . . Notepad, message from other operator
2219/23125 . . . Switch display to show different things, test or normal state
2219/23126 . . . Display tree structure of whole system or relevant info after function selection
2219/23127 . . . Switch from one kind of display to other, selected by duration discrimination
2219/23128 . . . Switch from one kind of display to other when parameter is changed
2219/23129 . . . Animated display, changes as function of parameters
2219/23131 . . . Select on large display part of pictogram to show on display of used workstation
2219/23132 . . . Multifunction display
Animated, rotating fan indicates speed, flashing bulb for intensity
Display history of used, selected programs, their frequency
Display to console, panel which sends parameters, commands
Display all subsystems, select one and display screen corresponding to subsystem
Display program step, instruction number
Linear, bar display of variables
Segment display
Flat panel, thin film electro luminescent
Colour display
Adjustable display
Kind of display, matrix like display, large surface
Blinking, flickering display
Programmable, reconfigurable via microprocessor or coding switches
LCD liquid crystal display
Helmet display, mounted on head of operator
Dual, two displays
Highlight
Large and several smaller displays for each workstation, each own cursor on large display
Controlled load, lightbulb, roller blind itself acts as display to acknowledge command
Line of light diodes LED
Display on screen reference value and sequence steps
Show upper, lower value, position with upper, lower segment of 7-segment display
Display process, synoptic, legend, pictogram, mimic
Display of evaluated and selectable program
Display plurality of parameters simultaneously
Hand held terminal PDA displays machine control program when user is near that machine
Display real time or time already elapsed or rest time for program
Display enlarged, zoomed detail and small overall schematic, plan
Display data on a scrolling line, ticker display
Display of parameter plus permissible, allowable range
Display program in fast, quick, speed mode
Display of selected sequence, permissible sequence
Display progress of program
Operation field together with control parameters
Display dynamic change of process, animation
Different states with one LED, blinking, on and off or different colours
Display modified program together with original program to see differences
Display of parameter and several suggested values for that parameter
What to display: program channels, running of program
Display entered data for each controlled station
Indicate all selected devices operating currently
Display status of currently selected controlled devices
Warning display if heavy energy consuming program steps are selected
Use of sound, acoustic, voice
3D display of controlled system
Display effects of high level commands
Display different states by using two leds, first blinks, then second, then both
Setting of internal dipswitches, jumpers
Visual display of workpiece with actions to execute on
Display number of each program
Software independent and dependent of hardware
Information is code
Command to control simultaneously several machines
A limited number of programs to be used by plurality of machines, multiplex
Memory stores lifetime, different settings, configurations of controlled device
Check validity data by writing in sector control data and check data
Memory stores available, allowable, possible options, variations, alternatives of program or modules
From lookup table and real time clock, select actual daylight period
Curve entered with pen on touchscreen
Disk with segments connected to separate input of microprocessor, represents different values
Reference value, setpoint for regulator
Value is analog signal
Curve, surface represents analog value, line, surface follower
Curve represents analog value, tv scan
Reference in coded form
Reference together with sequence commands
Set reference as function of position, for compensations
Capacitive detection of line
Potentiometer
Linear potentiometers with multiple sliders
Limit value to tolerances, ranges, plausibility
Store entered data, program status, reread regularly, against data loss
Check validity of entered data
Checksum CRC
Check data validity in ram, keep correct validity, compare rom ram
Extend processing time by extending enable signal with special output signal
Parallel processing
Interrupt queued requests only at the end of each segment of each of requests
Different tasks in different memory, called as function of priority of tasks
Each event can have two sub events, device can be activated twice in cycle
On off time tables, as function of angle, each linked to groups for device selection, pointer
library linking

DDE direct data exchange, DLL dynamic

Use control template library

Grafcet

continuous

Hybrid programming, part sequence, part

Object oriented programming, OOP

filled in by operator

Expert system

language

High level language HLL, basic, control

language

Synchronous language

Use control template library

DDE direct data exchange, DLL dynamic

library linking

C++
Endless tape, loop

Ram rom memory

Film

Ram rom memory

Endless tape, loop

G05B

Transfer program from ram to eprom, flash, card

System boot only allowed after inputting user identification, password

Load new program together with test program

Load program from attached device to control that device

Load program to initial configure machine, then erase and install user program

Switch between initialisation, program, test, end of programming, erase mode

Normal and emulated, pass through for disabled persons modes

Standby, inactive, sleep or active, operation mode

Safe mode, secure program, environment in case of error, intrusion

Mode, two mode, directly from console or download from host

Microprocessor control or manual control

Switch between manual, automatic, inching or step by step mode, select mode

Hand, manual or automatic

Select between entry and execution of program

Separate update program onboard

Transfer modified data from ram to eprom, flash after system have run several cycles

Clone, duplicate hardware functions of another device

Modification of program in real time

Modification program

Modification, correction entered values

Patch program during non execution, tables to load modified program

Overide stored parameters

Modify program and store it

Use of table with addresses for different modules, write new table if modified

History, log of program modifications

Identification of program, application, device to be controlled

Modify if history of program coincides with history of modifying data

Transfer modified program from ram to eprom, flash

Update diskette, cassette initiates bootstrap program to load eprom, flash

Only new module in high level language, combine with existing modules

Pluggable rom, smart card

Earom, alterable eprom, erasable

Changeable memory, program

Memory is eprom

Permeability of pin sets frequency of oscillator, record carrier

Eeprom

Programmed parameter values in memory, rom, function selection and entry, no cpu

Pluggable pin module, fits in corresponding female receptacle, coded plug

Film

Endless tape, loop

Hard disk

Magnetic card

Programmable, pluggable module, logic set up on front of module

Grammophone record, disk

Program card with integrated control panel, flexible circuit

Screw like form of record carrier

Ram card with write protection switch

Floppy diskette

Barcode

Bubble memory

Ferrite memory

Temperature induced on tape, sensors read temperature as program data

Card with picture of work to be done, together with selectable codes

VRAM videoram

Memory in controlled device is ram, rom

Fixed and variable memory for parameters or user program

XY matrix, switching controlled by pc

Interactive guidance by voice message

Set potentiometer automatically

Function switch, knob with piezo, strain gauge

Template for program, set values to template

Touch screen, with representation of buttons, machine on screen

Touch sensitive key

Knob, delivering pulses, digipot, electronic potentiometer

Balls with different properties circulate and form the sequence

Knobs with build in illumination, legend

Lightpen

Tape, card with magnetic, luminescent, iron particles for sequence

Programming pencil, touch probe

Voice, vocal command or message

Trackball

Mixure of different means, joystick, keys, pedals, fader, potentiometer

Modular program, each process has corresponding program module

Each module can transfer data to I-O or other module and has parameter memory

Change execution time ratio of several programs

Set finish, end time and total program time to calculate, derive begin, start time

Set time constant

Set value of limit switches, high low value

Enter start and end of selected program

Set day, week

Set start time and duration

Adapt set parameter as function of measured conditions

Programmer has connection with pc to enter parameters into system directly by pc

Edit reference value on screen by lightpen

Store edited program also in detachable programmer, can be used elsewhere
If data error detected, switch automatically to program mode
Change settings of events for a whole group of related events
Programmer device, portable, handheld detachable programmer
Program machine during execution of other programs in real time
Handheld programmer has cover to protect operator from environment
Portable, detachable programmer has emulation for fixed control panel
Voltage supply or allow, not inhibit signal to memory on connection of programmer
Discriminate with id code the module to be programmed
Remote programmer can only program a device if nearby, narrow beam communication
Pc as detachable program, debug, monitor device for control system
Program each station with specific data, all, global with general, common data
Enter application program into I-O module, like motion program, servo program
Read program from plugable memory card
Read tape, card forward, backward, in two directions
Automatic passage of tape to reader
Record program on tape, disk, memory
Learn parameters by producing a small number of objects
Record playback
Select construction element from function library
Selection of program, adaptive to process
Layout of program choice around knob according to used intensity
Selection out of several programs, parameters
Select program from look up tables as function of detector states, pointer, index to program
Selection as function of connected machine
Change program on detection of deviations
Select as function of different connected tools, each tool has its parameters
Selection of program as function of connected keyboard, panel
Select automatically preferred program data, ordered to most used program
Select a program per zone to be controlled
Select by dipswitches on power on
Each operator can select his own program, data entry
Select application program as well as connected control device
Select additional program functions by pushing two different keys
Select between user program selection or service program selection
As function of colour or number code on object to be treated
Upon detected function changes of remote device, activate proper local program
Select as function of surface property, characteristic of object handled by machine
Real time simulation
HIL hardware in the loop, simulates equipment to which a control module is fixed
Uses process simulator to develop, simulate faults, fault tree
Find optimum solution by simulating process with constraints on inputs
Use of an additional dedicated processor for emulating sensor output
Software in the loop, bypass function, execute new program parts on external device
Simulate sequence on display to control program, test functions
Pc simulates equipment and is connected to sequencer to test program
Execute program in fast mode, real system has no time to respond
Determine capability of machine by simulating model of capability of its parts
Model machine for simulation
Programmer magnetically attachable to machine
Remote controller pluggable, attachable to pc
Keyboard attachable, pluggable into household apparatus
Module has coded cams darkning optical detectors
No local entry panel, only central remote programmer for all appliances
Before controlling module execute monitoring of module and its resources
Use signatures to know module is not corrupt, cfc, control flow checking
Master processor blocks input of data to slaves
Block, latch entry keys once program launched
Code and program on two objects to be assembled, compared for compatibility
Before switch to execution of second, non failsafe program, inhibit I-O for it
Execute alternatively a failsafe, proven program and a non failsafe program
Interrupt after set time non failsafe program, switch to failsafe program
Confirmation of user for the selection of a program setting
Program stopped if consumed current to high
Pc safety
Maintenance, repair
Clock failing, adaptive to clock
Emergency stop
If control lever, joystick, handle is released, spring return to neutral
Inhibit update control program if default values has been changed by program during processing
Code coverage memory: contains data about addressed addresses during program run
Backup data if microprocessor not responding
Safety integrity level, safety integrated systems SIL, SIS
If board, card is retrieved, then disconnect first power, then block machine
Transmit warning, error message to all devices in a list
Use camera of handheld device, head mounted display
Unlatch all relays in common with microprocessor
Protection to extract, insert circuit board
Monitoring
Unlatch for reparation
Powering up, starting machine supervised by microprocessor
Computer assisted repair, diagnostic
Computer assisted maintenance
Separate processor for monitoring system
Stop error message after a number of repeated error events
Stop error message after permission operator, acknowledgement
Safety, surveillance
Remove board with system on power, hot plug in, swap, docking, life insertion
Latch, block unlatch, unblock
Circuit, independent from microprocessor, detects contact switch to allow power to actuator
Explosion free control, intrinsically safe
Alarm if wrong device, apparatus is connected to control module
Fpga takes over control if emergency or programmed stop, to shut down sequence
Power on reset, powering up
Failure, fault detection and isolation
Model checker, to verify and debug control software
Superpose testsignal on normal I-O lines, through transfo and rectifier
Test signal generated by microprocessor, for all I-O tests
Switch on pin of microprocessor for test
Several test signals stored in memory and used as input signals
Test sequence time and sequence profile
Pc as detachable debug, monitor device for control system
Signature analysis, compare recorded with current data, if error then alarm
Test memory comparing with known stored valid memory states
Second controller monitors diagnostics system of first controller
Test if memory card is inserted, present
Test if controller has enough memory available
Count certain number of errors, faults before delivering alarm, stop
Remote test, monitoring, diagnostic
Use of control bits
Two test pins, one for input and one for output
Set switch on for diagnostic
Diagnostic of controlled machine
Self diagnostic
Trace, store a working, operation history
Portable, detachable module to input test signals, read test results
Set jumper on board to change user mode to diagnostic mode
Remote testing, monitoring independent from normal control by pc
Diagnostic programmed in state logic
Simulator, generates input signals, shows output signals of logic
During simulation, test inhibit output to actuators
Select signals as function of priority, importance for diagnostic
Sample rate variable as function of importance of alarm signals
Real time diagnostics
Monitor only devices essential to current process
Processor stores variables, events and date in eeprom, for external monitor
Find intermittent errors
Diagnostic
Online service documentation
Detect faulty circuit, display on screen and replace it
Avoid propagation of fault
Probability of defect, severity or severity of defect, fault
Predict control element state changes, event changes
Markov model for safety analysis
Module detects wear, changes of controlled device, statistical evaluation
Debounce, correct periodicity of command
Detect correct command wave form
Detect valid sequence of commands
Detect if driver, actuation circuit is correct
Detect if actuators are correct, react
Remote and local monitoring, local result to remote, remote takes action
Analyze, trace fault signals according to tree, table
Expert system, guidance operator, locate fault and indicate how to repair
After correct repair, update fault tree
Simulate process graphically using feedback from real, to prevent or repair
Change colour of message after reading message
Display indication out of order, alarm indication
Warning display lights, lamps, leds on module
Display, show place of error, fault
Voice alarm
Show timely order of errors
Show number of error event
Camera monitors controlled machine
Scan and display states of all actuators if controller fails
On error, send error over lightdiode to external pc, display
Stop error message after a certain time
Display status of controller
Graphical display of proces as function of detected alarm signals
Operator can select a graphical screen at his will as help diagnostic
If interference inhibit entry
Test for collision of actuated devices, articles, if interference inhibit entry
2219/24189 . . . Redundant processors monitor same point, common parameters
2219/24191 . . . Redundant processors are different in structure
2219/24192 . . . Configurable redundancy
2219/24193 . . . Two transducers for same parameter
2219/24194 . . . One channel monitors correct program code execution, other correct process state
2219/24195 . . . Compare data in channels at timed intervals, for equality
2219/24196 . . . Plausibility check in channels for correct sequence or result
2219/24197 . . . Dual analog output ports, second takes over if first fails
2219/24198 . . . Restart, reinitialize, boot system after fault detection, hanging up, stalling
2219/24199 . . . Recover from fault, malfunction, go to safe state, correct and set new sequence
2219/24201 . . . Inhibit restart program if start switch fails in normal run mode
2219/24202 . . . After failure and stop of program, special switch to restart
2219/24203 . . . Restart, recover from error only if detected states equal stored states
2219/24204 . . . Select restore procedure corresponding to matched abnormal condition, table
2219/24205 . . . Slow down processor activity if temperature rises above limit
2219/24206 . . . Identification by portable memory in a key
2219/24207 . . . If processor overloaded, reduce messages sent by other systems to it
2219/24208 . . . Go into safety mode if communications are interrupted
2219/24209 . . . Create film in case of error
2219/24211 . . . Override normal program, execute urgency program so machine operates safe
2219/24212 . . . Set off alarm state manually, acknowledge to restart normal control
2219/24213 . . . No shut down if after emergency detection, all control parameters are safe
2219/24214 . . . Detect if analog output signal is within range
2219/24215 . . . Scada supervisory control and data acquisition
2219/24216 . . . Supervision of system
2219/25 . . . Pc structure of the system
2219/25001 . . . CEBUS consumers electronics bus
2219/25002 . . . Interbus-S, output serial out, input serial in, as one shift register
2219/25003 . . . M3S bus with six lines, two power, two canbus, one to initialize, one as dead man switch
2219/25004 . . . Power and data bus
2219/25005 . . . Fluid bus for communication in process system with several fluidic control modules
2219/25006 . . . Interface connected to fieldbus
2219/25007 . . . UMS bus
2219/25008 . . . Different buses, protocols on same line, also dsl
2219/25009 . . . Profinet-I-O, producer-consumer mode
2219/25011 . . . Domotique, I-O bus, home automation, building automation
2219/25012 . . . Two different bus systems
2219/25013 . . . G64-bus
2219/25014 . . . Fieldbus general name of bus connected to machines, detectors, actuators
2219/25015 . . . Gpib-488, ieee-488, hp bus, parallel instrumentation bus
2219/25016 . . . Eiba bus, european installation bus association, ib installation bus
2219/25017 . . . ASI actuator sensor interface, bus, network
2219/25018 . . . Only actuator bus, network
2219/25019 . . . Parallel processors coupled to bus by configurable interface card
2219/25021 . . . Profinbus
2219/25022 . . . LAN local area network for controllers
2219/25023 . . . Sercos serial real time communications system between servos and cpu
2219/25024 . . . Bitbus from intel
2219/25025 . . . Only sensor bus
2219/25026 . . . Lon local operating network, uses neuron chip with three microprocessors
2219/25027 . . . GSC general serial channel
2219/25028 . . . Power, data and clock bus
2219/25029 . . . Additional logic to mirror certain signals, permits node to adapt to bitrate
2219/25031 . . . TTCAN bus, time triggered can bus
2219/25032 . . . CAN, canbus, controller area network bus
2219/25033 . . . structure, control, synchronization, data, alarm, connect I-O line to interface
2219/25034 . . . Connect module to data, monitor, control lines, extra I-O and power to connector
2219/25035 . . . Star network
2219/25036 . . . Two clocks, high frequency for normal and low frequency for battery low, sleep
2219/25037 . . . Clock line and data line loop in a contrary sense, for data stability, settling
2219/25038 . . . During negative cycle of power supply, processor is set to active, else inactive
2219/25039 . . . Clock
2219/25041 . . . Select between several clock signals
2219/25042 . . . Clock derived from power supply
2219/25043 . . . Superposition time and other pulses
2219/25044 . . . Radio controlled clock
2219/25045 . . . Electronic cam, encoder for sequence control as function of position, programmable switch pls
2219/25046 . . . Real time clock to sample I-O states and store them in memory
2219/25047 . . . Common clock for redundant processors
2219/25048 . . . Master clock and several frequency dividers, for motion and sequence control
2219/25049 . . . Master processor gives timing information to slaves
2219/25051 . . . For serial communication a separate clock and data line
2219/25052 . . . VCO voltage controlled oscillator
2219/25053 . . . Frequency pulses as function of speed
2219/25054 . . . Calibration timer, compare 1st, number of pulses during calibration with second counter
2219/25055 . . . During calibration adapt vco, counter to deliver wanted frequency, pulses
2219/25056 . . . Automatic configuration of monitoring, control system as function of operator input, events
2219/25057 . . . Configuration stored in distributed database for real time use
2219/25058 . . . Job setup, use also library to select job setup
2219/25059 . . . Iterative configuration of identical modules, only config first one, copy to other
2219/25061 . . . Configuration stored in central database
2219/25062 . . . Detect physical location of field device
2219/25063 . . . Force node into an inactive state when required
2219/25064 . . . Update component configuration to optimize program execution
2219/25065 . . . Configure attributes of parameters
2219/25066 . . . Configuration stored in each unit
2219/25067 . . . Graphic configuration control system
2219/25068 . . . Check correct configuration of device
2219/25069 . . . Pseudo redundancy, eliminate failing element and reconfigure system
2219/25071 . . . Synoptique display of system configuration, layout, evolution
2219/25072 . . . Initialise each module during start up
2219/25073 . . . Configuration of keys and related display, shown on keys
2219/25074 . . . Check system, change failing element, compare with stored configuration
2219/25075 . . . Select interconnection of a combination of processor links to form network
2219/25076 . . . Configure connected module only if allowed, registered module
2219/25077 . . . Each module can be programmed for number of input and output
2219/25078 . . . Store in ram a second program adapted to local conditions
2219/25079 . . . Function module makes bus termination, creates local bus on ok from central
2219/25081 . . . Clone, copy configuration from first device, in teach mode, to second identical device
2219/25082 . . . Display name of configuration, to recognise how device has been set, programmed
2219/25083 . . . For each subsystem a configuration
2219/25084 . . . Select configuration as function of operator
2219/25085 . . . Several function expansion units for master, main unit, universal system
2219/25086 . . . Assign functions to group of complete or partial cells, modules
2219/25087 . . . Selector switch to set function of each module
2219/25088 . . . Define scale value of analog signal, min and max value
2219/25089 . . . Define state of digital signal, open, closed, maintained, momentary
2219/25091 . . . Of alternative and parallel parts of program into synchronised tasks
2219/25092 . . . Customized control features, configuration
2219/25093 . . . During start, integration into machine, send module functionality to scheduler
2219/25094 . . . At start, I-O modules receive functionality and check with its own functionality
2219/25095 . . . Detect kind of display to configure display routine
2219/25096 . . . Detect addresses of connected I-O, modules
2219/25097 . . . Detect control panel connected, select corresponding program and parameters
2219/25098 . . . Detect connected sensors, set parameters, gain automatically
2219/25099 . . . Detect configuration I-O and select needed program
2219/25101 . . . Detect connected module, load corresponding parameters, variables into module
2219/25102 . . . Detect connected actuator, by code, select compensation non linearity
2219/25103 . . . Detect during start, number of modules, groups, sub groups
2219/25104 . . . Detect transfer of control module, use mean default values instead of normal
2219/25105 . . . By cable integrated in controlled machine, fixed
2219/25106 . . . Pluggable card, magnetic, smart with configuration data, pulled out after loading
2219/25107 . . . Pluggable card, magnetic or smart with configuration data, staying in device
2219/25108 . . . Dip switches combined with bcd switch instead of multiple dip switches
2219/25109 . . . Eeprom loaded from external device with configuration data
2219/25111 . . . Using broadcast message
2219/25112 . . . Using firmware stored in processor
2219/25113 . . . Strapping diodes
2219/25114 . . . Jumpers
2219/25115 . . . Card, board with configuration switches
2219/25116 . . . Pluggable, detachable cassette loads configuration
2219/25117 . . . Resistors, value, combination defines a digital value
2219/25118 . . . Matrix to connect sensor to corresponding actuator
2219/25119 . . . Dip switches dip switch
2219/25121 . . . What, which input or output to be connected to key or display
2219/25122 . . . Stop angle and status of different on off states
2219/25123 . . . Change controller pin configuration
2219/25124 . . . Configure attributes of parameters
2219/25125 . . . Relationship between different functions of a controller
2219/25126 . . . Synchronize communication based on internal clock of microprocessor
2219/25127 . . . Bus for analog and digital communication
2219/25128 . . . Transmission with higher frequency than the processing frequency
2219/25129 . . . Programming a multitasking, virtual sensor network shared by various users
2219/25131 . . . Collect several parameters and transmit in block to control microprocessor
2219/25132 . . . Superposition data signals on power lines for actuators
2219/25133 . . . Serial parallel conversion
2219/25134 . . . All interfaces load their data in shift register, then serial read out
2219/25135 . . . On data line multiplex data and control words
2219/25136 . . . Transmission with variable frequency, set by operator
2219/25137 . . . Optical window for communication
2219/25138 . . . Transmit data from rotating devices
2219/25139 . . . Use of separate bus couple interface
2219/25141 . . . Normal display led used also for communication purposes
2219/25142 . . . Lan between host and main controller, other network between main and sub controllers
2219/25143 . . . Buffer for communication between two cpu
2219/25144 . . . Between microcomputers, processors
2219/25145 . . . I-O communicates with local bus at one end and with fieldbus at other end
2219/25146 . . . Communication between main and expansion unit, only clock and data
2219/25147 . . . Before communication, check if optical fiber is correctly attached
2219/25148 . . . Before communication, check if I-O is powered
2219/25149 . . . Receiver detects communication error and requests emitter to retransmit data
2219/25151 . . . Check appropriate protocol voltage levels
2219/25152 . . . Parity detection
2219/25153 . . . Checking communication
2219/25154 . . . Detect error, repeat transmission on error, retransmit
2219/25155 . . . Encoded transmission against noise
2219/25156 . . . Full echo communication check, echo back
2219/25157 . . . Checksum CRC
2219/25158 . . . Watchdog
2219/25159 . . . Respond to signal if initialisation and address are received within set interval
2219/25161 . . . Only receiving station, read several times message, select correct one or reject
2219/25162 . . . Contention, if several transmitters avoid collision, by separate transmitter code
2219/25163 . . . Transmit twice, redundant, same data on different channels, check each channel
2219/25164 . . . Loopback
2219/25165 . . . Token ring network
2219/25166 . . . USB, firewire, ieee-1394
2219/25167 . . . Receive commands through mobile telephone
2219/25168 . . . Domotique, access through internet protocols
2219/25169 . . . Half duplex, repeater
2219/25171 . . . Serial, RS232
2219/25172 . . . Duplex
2219/25173 . . . SCSI
2219/25174 . . . Ethernet
2219/25175 . . . Modem, codec coder decoder
2219/25176 . . . RS485, differential data signals, xor
2219/25177 . . . Using fm frequency modulation, fsk, biphase code
2219/25178 . . . Serial communication, data, also repeater
2219/25179 . . . Parallel
2219/25181 . . . Repeater
2219/25182 . . . Serial between host and modules, nodes, parallel in node to microcontroller
2219/25183 . . . Serial AND-OR parallel interface in one circuit
2219/25184 . . . Number of modules interfaces optimized in relation to applications with which to link
2219/25185 . . . Single serial line, virtual second line is earth
2219/25186 . . . Bluetooth
2219/25187 . . . Transmission of signals, medium, ultrasonic, radio
2219/25188 . . . Superposition high frequency data signal on power lines, current carrier
2219/25189 . . . Current mode sensor I-O, current loop, 40-mA loop instead of voltage
2219/25191 . . . Current loop
2219/25192 . . . Infrared
2219/25193 . . . Coaxial cable
2219/25194 . . . Twin core, twisted cable
2219/25195 . . . Multiwire cable, parallel
2219/25196 . . . Radio link, transponder
2219/25197 . . . Optical, glass fiber
2219/25198 . . . Brouter: transfers data from wireless to wired networks, router: wired to wired
2219/25199 . . . Router brouter broadcast configuration data periodically to update control units
2219/25201 . . . Program communication between remote I-O and controller via remote connection program object
2219/25202 . . . Internet, tcp-ip, web server : see under 505B219-40
2219/25203 . . . Keep correct order of messages sent, of messages sequence
2219/25204 . . . Translate between different communication protocols
2219/25205 . . . Encrypt communication
2219/25206 . . . Protocol: only devices with changed states communicate their states, event
2219/25207 . . . Only devices with changed states can receive control signals for actuator
2219/25208 . . . Control message, address and command portion
2219/25209 . . . Device status answer, response, acknowledge
2219/25211 . . . Broadcast mode, length message, command, address of originator and destination
2219/25212 . . . Master address node, node answers ready, master sends command, node executes it
2219/25213 . . . Synchronisation, address and data
2219/25214 . . . Wait, delay after message
2219/25215 . . . Time triggered protocol for fault tolerant real time application
2219/25216 . . . Packet switching
2219/25217 . . . Configure communication protocol, select between several
2219/25218 . . . Broadcast mode, originator, destination address, command, check data
2219/25219 . . . Probe packet to determine best route for messages
2219/25221 . . . Identification of messages and their relative priority
2219/25222 . . . Mailbox, email, mail system
2219/25223 . . . Slave has registers to indicate master, acknowledge, transfer address, read write
2219/25224 . . . Fieldbus messages services fms
2219/25225 . . . Peripheral messages services pms, for sensor actuator
2219/25226 . . . Combine CSMA-CD and TDM time multiplexed for rapid status exchange
2219/25227 . . . Polling time is variable for each node, as function of time needed for each node
2219/25228 . . . Scheduling communication on bus
2219/25229 . . . Partition control software among distributed controllers
2219/25231 . . . Command, task has deadline, time limit to be executed
2219/25232 . . . DCS, distributed control system, decentralised control unit
2219/25233 . . . Avoid communication delay by sending command and event, if event present, execute command
2219/25234 . . . Direct communication between two modules instead of normal network
2219/25235 . . . Associate a sequence function to each control element, event signature
2219/25236 . . . Detail, detect presence of operator to wake up system
2219/25237 . . . Drive record carrier
2219/25238 . . . Personalize message
2219/25239 . . . Relay assisted triac, in series for safety
2219/25241 . . . Serial bus controller
2219/25242 . . . Relay
2219/25243 . . . Digital filter
State matrix connected to controller
Keyboard encoder chip used as sequence controller
Habituation, rehabilitation and recovery chip, responds only to critical information
Program drum and reverse drum driven by timer motor
Microcontroller as time switch
Counter, timer plus microprocessor for real time, jitter
Real time clock
Microprocessor
Transputer
DSP digital signal processor
Neural network
Module is timer with variable time delay
Microcontroller
ASIC
Bus arbiter
Hand calculator as time switch
Oscillator to multiply pulses to counter
Solid state simulating relay logic
Synchronizer for pulses
Flash memory
Microcontroller combined with plc
Shift register
PLD programmable logic device
Lifo
Neuron controller, for lan
Hall sensor, switch
Fuzzy logic combined with delay element
Communication processor, link interface
Analog switch
Fifo
Tristate
Timer plus microprocessor
Switch on power, awake device from standby if detects action on device
Detect usage of machine, adapt sleep mode timer
Alternative energy for fieldbus devices
Evaluate available energy prior to wireless transmitter-receiver activation
Standby only for memory, prom
Standby only for real time clock
Switch on power, awake controlled machine from standby if command signal
Power for display leds I-O only when case is open
Detector to standby state if signal below certain level
Energy saving, brown out, standby, sleep, powerdown modus for microcomputer
Set module, component to sleep if no event or no other module needs it
Standby for display, switch on if operator wants to use it
Identify control parameters for several workpieces, control, both in parallel
Part, workpiece, code, tool identification
Identification has information on relationship with other controllers
Identification module, type connected I-O, device
Identify controlled element, valve, and read characteristics
System identification
Address memory with variable frequency
Expansion of system, memory
Program and data in separate memory
Decode processor status bits to switch, select between memories
Memory subdivided in separate blocks, high, low addressable with same address
MMA, memory management, set ram and eprom part for flash memory, store state also
Modules with hardwired logic
Each module has file with all components in module and the available components
Ecu, standard processor connects to asic connected to specific application
Module in ring for power supply and ring for command signals
Each module near controlled machine
Pneumatic, hydraulic modules, controlled valves
Clamp module on controlled system by magnet
Modular structure, modules
Module, sequence from module to module, structure
Control unit and actuator in one unit, module
Control unit, sensor and actuator in one unit, module
Power supply module in common for all modules
Standard connector between modules
Connection modules by flexible printed circuit, printed cable, multiway, ribbon
Stackthrough modules, modules are stacked, no need for backbone
Intelligent modules
Modules connected to serial bus
Each connected module has own power supply
Module with low maintenance connected to removable module with high maintenance
Single channel module
Module connected to parallel bus
Each module, segment has only either a sensor or an actuator
Module connected to canbus and to controlled device
Module capability concerns allowable I-O and required sequence of operations
Modules on bus and direct connection between them for additional logic functions
Each module contains several channels, each with an input and an output
Each module has connections to actuator, sensor and to a fieldbus for expansion
Cascaded modules, one module connects to other, I-O, computing expansion
She single board computer, stand alone
Microprocessor
Supervisory plus control computer
Single chip programmable controller
2219/25342 . . . Real time controller
2219/25343 . . . Real time multitasking
2219/25344 . . . In one cycle, application task is executed, if time is left, communication or user interface task is executed
2219/25345 . . . Linux, preemption, low-latency patches for real time linux
2219/25346 . . . Several operating systems in one device
2219/25347 . . . Multitasking machine control
2219/25348 . . . Windows expansion for real time control under windows
2219/25349 . . . Operating system, Microsoft Windows
2219/25351 . . . MSDOS
2219/25352 . . . Preemptive for critical tasks combined with non preemptive, selected by attribute
2219/25353 . . . Inductive coupling of power, transformer
2219/25354 . . . Power or secondary control signal derived from received signal
2219/25355 . . . Motor winding used as power transformer
2219/25356 . . . Inductive coupling of power and signal
2219/25357 . . . Regulation of energy coupling
2219/25358 . . . During detection of input, switch over to dc power
2219/25359 . . . Special power supply
2219/25361 . . . DC-DC convertor on board
2219/25362 . . . UPS, no break
2219/25363 . . . Dual power supply, for digital circuit and for analog signals
2219/25364 . . . For each module a powersupply
2219/25365 . . . Initialize parameters
2219/25366 . . . Detect code, kind connected machine, device before execution of program
2219/25367 . . . Control of periodic, synchronous and asynchronous, event driven tasks together
2219/25368 . . . Start group of motors, machines in sequence, power up, down sequence
2219/25369 . . . Control of states, real time
2219/25371 . . . Recharge apparatus with material, only when needed or during specific time
2219/25372 . . . Sequence command, next step if reference equals ramp signal level
2219/25373 . . . Detection position of program drum
2219/25374 . . . Home selection
2219/25375 . . . If error, execute subroutine for alternative command, no shut down
2219/25376 . . . Repeat part of program, kind of subroutine
2219/25377 . . . New sequence as function of deviation from predicted result, state
2219/25378 . . . Stop machine after execution of some instructions on tape, marked by code
2219/25379 . . . Operation on rotating table provided with a plurality of cases
2219/25381 . . . Restart program at predetermined position, crash recovery after power loss
2219/25382 . . . Skip sequences
2219/25383 . . . Jump
2219/25384 . . . Analog I-O to microprocessor to set switch moment for next step
2219/25385 . . . Control speed of conveyor as function of missing objects, to speed up
2219/25386 . . . Program execution as function of direction, forward or backward
2219/25387 . . . Control sequences so as to optimize energy use by controlled machine
2219/25388 . . . Race conditions
2219/25389 . . . Macro's, subroutines
2219/25391 . . . Start, stop sequence of different parts of machine, copier, textile, glass
2219/25392 . . . Convert control signal to deliver pulse modified in time and width
2219/25393 . . . Speed, delay, stand still of record carrier controlled, more commands possible
2219/25394 . . . Execute next step on feedback of result of previous step
2219/25395 . . . Clock dependant, select next cyclus, step as function of parameter
2219/25396 . . . Add pulses or stop pulses as function of changing clock, speed to compensate
2219/25397 . . . Compare real date with programmed date, if equal execute next command
2219/25398 . . . Sampling period is a product of integer number and scheduler interrupt period
2219/25399 . . . Variable, settable clock or cycle, phase duration
2219/25401 . . . Compensation of control signals as function of changing supply voltage
2219/25402 . . . Detect occurrence of signal by higher sampling when parameter value within range
2219/25403 . . . Compare real clock time with programmed time, if equal execute next command
2219/25404 . . . Command order is delayed as function of expected and real delay
2219/25405 . . . Command order is delayed, corrected as function of speed
2219/25406 . . . Delay as function of detected characteristics of controlled element
2219/25407 . . . Delay between operations
2219/25408 . . . Given order is latched for a certain delay in order to execute order surely
2219/25409 . . . Feedforward of control signal to compensate for delay in execution
2219/25411 . . . Priority interrupt
2219/25412 . . . Separate interrupt for, from each interface
2219/25413 . . . Interrupt, event, state change triggered
2219/25414 . . . Interrupt without saving register states
2219/25415 . . . Between processors using a single line and a switch
2219/25416 . . . Interrupt
2219/25417 . . . Identify capabilities necessary to produce article
2219/25418 . . . Enter description of capabilities of each module
2219/25419 . . . Scheduling
2219/25421 . . . Using resource data relative to each component, module of control system
2219/25422 . . . Aperiodic scheduling, executed only on certain condition
2219/25423 . . . Verification of controlled value by comparing with recorded value, signature
2219/25424 . . . Mixture of wall connectors, some with fixed address others no address
2219/25425 . . . Personal computer
2219/25426 . . . Microcontroller in smart card directly controls machine, runs control program
2219/25427 . . . Controller inside socket, wall connector, distributor, junction box
Field device
Microprocessor mounted near controlled machine, cheaper line connection
Dual Port memory
Multiplex
Dataflow processor
Microprocessor and control logic integrated on same circuit board
Multiplex for analog signals
Main board connected to bundle of analog input lines
Main board coupled to bundle of digital and analog input lines
Counter controls device, machine directly or via decoder
Use of flexible printed circuit
Europa card
Connect pc card to industrial bus, additional timing and adapting logic
Stick label over opening for card, to seal opening and indicate program status
Electric wiring inside pneumatic, hydraulic path
Serial port has power connected to pin for external device
Detachable program unit can be replaced by supplementary display
Control module is pluggable into wall connector
Constructive details
Connect module to bus using interface with adaptive logic
Bootstrap logic and ram integrated in serial connector
Encoder, control knob connected to same microprocessor pins as keyboard matrix
Retrofitting
Buscouple interface can be integrated in actuator
Piggy back controller, old controller functions as before, new functions by new replacing
Replace old processor by more powerful processor on additional card
Opto isolation, optical separation
Reed relay separation
Transformer separation
Galvanic separation, galvanic isolation
Optical separation for signals, transformer separation for power
MBO motherboard, backplane special layout
Output of one module connected to input next module by lines on motherboard
Motherboard has data, address, power and module identification lines
Detect if expansion board is connected
Deconnect automatically high voltage supply when taking out a module
Inserting or taking out circuit boards during power on
 Replace existing control system with new different system in real time

Synchronise controllers, sensors, measurement with data bus
Compensation variable cycle time, synchronized processes
Synchronize microprocessor with process or I-O
Sequence synchronized with machine axis, like knitting machine
Synchronous state change by clock as function of allowed states to skip certain states
Master waits for signal from slave, slave active thereafter, during limited time
Synchronize several controllers using syncline
Synchronize controllers using messages, add transmission time afterwards
Broadcast to each controller an address of part of program to be used
Synchronize several sequential processes, adjust
Synchronize several controllers using messages over data bus
Synchronize microprocessor and connected, controlled state machine
Pc applications
Dispense machine glue, paste, flow
Water processing
Steering car
Test of external equipment
Wastewater treatment
Tape transport, take up, rewind, play
Infusion controller
Tape transport, take up, rewind, play
Hospital bed
Process control
Microprocessor driven caliper, to measure length distances
Data acquisition interface
Household appliance in general
HVAC, heating, ventilation, climate control
Audio, video, tv, consumer electronics device
Earth moving, work machine
Eye, ophthalmic, surgery system
Lubrication, greasing
Wind turbines
Conveyor, transfert line
Press
Combustion motor
Injection molding
Sprinkler, irrigation, watering
Sewing
Grinding machine
Door, window
Assembly line
Blasting, explosion
Hemodialysis
Washing, laundry
Loom, weaving
Glass forming
Reproduction, image copying machine
Vehicle, car, auto, wheelchair
Airconditioning
Energy management, use maximum of cheap power, keep peak load low
From computer integrated manufacturing till monitoring

Selection of assembly processes, preferred
Planning, generate assembly plans

Selection of inspection devices
Determination of assembly tooling, fixture assembly sequences

Planning, layout of assembly system
Planning, traveling salesman problem TSP

Machine balancing, distribute articles evenly if number reached

Computer assisted manual assembly CAA, redundant process controllers

Diagnostic controller coupled to field and to redundant process controllers

Selecting workpieces from one or more containers by robot with vision

Virtual factory, modules in network, can be selected and combined at will

Each station along transferline is independent

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Each station along transferline is independent

Assembly, manipulator cell

Two workstations alternatively, one assembles, other is prepared for next

Record on site dimensions of pipe, tube configuration, to install pipe

Component identifier and location indicator corresponding to component

Disable assembly if one of component compartments lacks

Load component into corresponding compartment, bin, storage before assembly

Compartment, bin, storage vessel sensor to compartment, bin, storage before assembly

Component identifier and location indicator corresponding to component

Disable assembly if one of component compartments lacks

Load component into corresponding compartment, bin, storage before assembly

Compartment, bin, storage vessel sensor to compartment, bin, storage before assembly

Component identifier and location indicator corresponding to component

Disable assembly if one of component compartments lacks

Load component into corresponding compartment, bin, storage before assembly

Compartment, bin, storage vessel sensor to compartment, bin, storage before assembly
Selection of assembly process parameters
Calculation of assembly times
Integrate assembly and task planning
Minimal precedence constraint for components, link between components
Disassembly evaluation
Virtual assembly disassembly planning
Assembly partitioning, find sub assembly removables without disturbing plan
Relative positioning of assembled parts with small geometric deviations
Cell controller, setup machine of cell during operation of other machines
Prevent order interference, no order to machine not setup for that order
Prevent batch breakup, no mix up of output of different machines
Decide when to create or reconfigure a cell
Decide which machines are to be used in a cell
Modular cell elements
Controller for cell, for robot motion, for supervision
Laser cutting table and handling and gripping and attachment robot and layup table
Several machines and several buffers, storages, conveyors, robots
Two workstations and two manipulators working together or independent
NDDS network data delivery service, producers and consumers model
Detect position robot, agv relative to machine to start communication
In server store virtual nodes for controlled machines, with states for map
Part of module exchanges high level messages, other part proprietary messages
Application scripts; in web server, not sent to client
Communication of carriage, agv data, workpiece data at each station
Transmission device between workcell and central control
Network communication between supervisor and cell, machine group
Direct communication between cooperating parts of a cell, not over server
One client handled by several servers
Network server for communication between plc’s, using server
Communication between sensors, actuators and gateway
Data exchange between modules, cells, devices, processors
Read write intelligent chip on workpiece, pallet, tool for data exchange
Data carrier, communication by exchange of floppy disk
Display travels with workpiece, package, order, special orders can be inserted
Configuration editor for networking interconnection
Configuration of transfer control between several subsystems

Configuration file with format of relevant messages for different equipment
Program network controller, connected devices
Configure parameters of controlled devices
Remote configuration of parameters of controlled devices
Remote control of network controller
Auto configuration, each module responsible for own configuration
Start up of object manager module
Can controller in full can, detects if message is for controller
Can controller in basic can, microcontroller detects if message is for controller
Can controller and microcontroller integrated
Interface, SIOMS standard I-O for mechatronic systems, device drivers
General, vendor independent display and control interface for sensor actuator
Sensor on off switch level can be set and displayed by detachable module
Network controller
A-D interface between asi and fieldbus
Each node has several, three channels, for control, for data, for addressing
Universal interface between asi and fieldbus, for any fielddevice
Fielddevice comprises also controller and pneumatic actuator and sensor
Fielddevice, field controller, interface connected to fieldbus
Bridge between networks
Multi mode network controller, monitor, control, configuration, maintenance
Interface between communication network and process control, store, exchange data
Signal, sensor adapted interfaces build into fielddevice
Transmitter coupled to fieldbus and to sensor, a-d conversion
Repeater between two networks
No repeater, split into several analog segments and common digital, can, expansion
Universal interface for different fieldbus protocols
Field device with gateway functions for communication with pc and other field devices
FDT interfacing profibus field device drivers
DTM with engineering tool
Contactless connector, identify module wirelessly, short distance like less than twenty cm
PCD profinet component description, field device description module
Fieldbus
Name of bus, canbus, controller area network
Sercos serial real time communications system between servo and cpu
Profibus process fieldbus
Lon local operating network, using neuron chip
Devicenet, can based net
Sds smart distributed system, can based
2219/31144 . . . Interbus-S
2219/31145 . . . Ethernet
2219/31146 . . . Bati bus, for home habitation building automation
2219/31147 . . . Simatic S5-bus
2219/31148 . . . Imbus
2219/31149 . . . P-net
2219/31151 . . . Lon local area network
2219/31152 . . . Separate lan for sensors, detectors
2219/31153 . . . Serial bus for plug in modules, each connection has own supply
2219/31154 . . . Actuator sensor bus, asi, intelligent actuator, motor, sensor
2219/31155 . . . Ringbus
2219/31156 . . . Network structure, internet
2219/31157 . . . Star network, hub
2219/31158 . . . Wan wide area network
2219/31159 . . . Intranet
2219/31161 . . . Java programcode or similar active agents, programs, applets
2219/31162 . . . Wireless lan
2219/31163 . . . Neutral bus with intelligent coupler for all kind of fieldbuses
2219/31164 . . . Bus for analog and digital communication
2219/31165 . . . Control handover in wireless automation networks
2219/31166 . . . Access data by name, object, stored in list, database
2219/31167 . . . Object, data object as network variable
2219/31168 . . . Use of node, sensor, actuator and control object
2219/31169 . . . Object manager contains client, control and communication and start and planning server
2219/31171 . . . Each data object has corresponding identification for object manager, associative
2219/31172 . . . All object managers use same algorithm to search server
2219/31173 . . . Start different object manager as function of priority list
2219/31174 . . . Load, use different protocols, formats, emulators for different systems
2219/31175 . . . Message comprises identification of sender, receiver, command and parameter
2219/31176 . . . Universal, same protocol to control all kind of drives, dc, ac, step motor
2219/31177 . . . Protocol, sdlc serial data link control
2219/31178 . . . Hdle high level data link control
2219/31179 . . . Master sends message with address of slave to all slaves, slave answers, interrupt
2219/31181 . . . Controller and device have several formats and protocols, select common one
2219/31182 . . . Address by pulse sequence, control by pulse width, module filters out own control
2219/31183 . . . Token ring
2219/31184 . . . Fip fieldbus instrumentation protocol
2219/31185 . . . Mapi message application interface for windows
2219/31186 . . . TCP-IP internet protocol
2219/31187 . . . Csma-cd csma-cd-w carrier sense multiple access collision detection wireless
2219/31188 . . . Combine csma-cd and tdm time multiplexed for rapid status exchange
2219/31189 . . . Time multiplex

2219/31191 . . . Shorten header, message can be sent with less bytes, short form PDU
2219/31192 . . . Token passing protocol, priority token passing
2219/31193 . . . Midi communication standard
2219/31194 . . . Multimedia integration into fieldbus
2219/31195 . . . WAP wireless application protocol, wireless web application
2219/31196 . . . SOAP, describes available services and how to call them remotely
2219/31197 . . . Near field communication nfc
2219/31198 . . . VPN virtual private networks
2219/31199 . . . UDP-IP
2219/31201 . . . Frequency shift keying modulation, fsk
2219/31202 . . . Semiconductor equipment communication standard SECS
2219/31203 . . . Purpose, identification of messages, programs, variables
2219/31204 . . . Blind node, executes control, data acquisition without having operator interfaces
2219/31205 . . . Remote transmission of measured values from site, local to host
2219/31206 . . . Exchange of parameters, data, programs between two station, station and central or host or remote
2219/31207 . . . Master sends global files to autonomous controllers, feedback of process status
2219/31208 . . . Server node to watch, store message, variable, data between lon, network
2219/31209 . . . Master actuator sensor interface has priority over host, build into host
2219/31211 . . . Communicate diagnostic data from intelligent field device controller to central
2219/31212 . . . Intelligent local node can handle emergency without communication over net
2219/31213 . . . Synchronization of servers in network
2219/31214 . . . Discontinuous communication controlled by server
2219/31215 . . . Upon modification of data in one database, automatic update of mirror databases
2219/31216 . . . Handshake between machine and agv; readiness to load, unload workpiece
2219/31217 . . . Merge, synchronize process data and network data for trend analysis
2219/31218 . . . Scheduling communication on bus
2219/31219 . . . Fixed deadline monotonic scheduling dm, set each message id to unique priority
2219/31221 . . . Non preemptive earliest deadline ed, message id contains deadline
2219/31222 . . . Mixed traffic scheduler, ed for high speed and dm for low speed messages
2219/31223 . . . Main controller with three levels of serial networks
2219/31224 . . . Supervisor, cell controllers in parallel bus, machine controllers in serial bus
2219/31225 . . . System structure, plc's and pc's communicate over lan
2219/31226 . . . Multitasking server connected to general network and to nc machines
2219/31227 . . . External network for proces data, internal network for transport, handling only
2219/31228 . . . Host, gateways and parallel backbone, multiprocessor computer node, fieldbus
2219/31229 . . . Supervisor, master, workstation controller, automation, machine control
G05B

2219/31231 . . . Lan and stations and fieldbus, each station controls own I-O
2219/31232 . . . Lan and station, each station has plc controlling own I-O over bus
2219/31233 . . . Map network and server in node and server controlled ethernet with machine nodes
2219/31234 . . . Host, router and backplane bus, communication with host or backplane
2219/31235 . . . St network, each module of first controls second similar network etc., tree
2219/31236 . . . Plc exclusive network connected to map
2219/31237 . . . Host and rs232, rs485 to network controller and rs232 to controlled devices
2219/31238 . . . First network connected by repeater to second, second connected by repeater to third
2219/31239 . . . Cache for server to fast support client
2219/31241 . . . Remote control by a proxy or echo server, internet - intranet
2219/31242 . . . Device priority levels on same bus, net, devices processes data of exactly lower priority device
2219/31243 . . . Add serial number to message from station to check missing messages in host
2219/31244 . . . Safety, reconnect network automatically if broken
2219/31245 . . . Redundant bus, interbus, with two masters
2219/31246 . . . Firewall
2219/31247 . . . Reconnect network if connection was broken
2219/31248 . . . Multiple data link layer masters, if one fails, other takes over
2219/31249 . . . Display name of communication line and number of errors detected and corrected
2219/31251 . . . Redundant access, wireless and hardware access to fielddevices
2219/31252 . . . Watchdog, client sends regular message to server, server must answer
2219/31253 . . . Redundant object manager
2219/31254 . . . Request from client waits until corresponding server functions again
2219/31255 . . . Verify communication parameters, if wrong, refuse communication
2219/31256 . . . Object managers arranged in logical ring for monitoring purposes
2219/31257 . . . Redundant wireless links
2219/31258 . . . Compensate control in case of missing message
2219/31259 . . . Communication inhibited during certain process steps
2219/31261 . . . Coordination control
2219/31262 . . . Deka dynamic coordinated concurrent activities
2219/31263 . . . Imbedded learning for planner, executor, monitor, controller and evaluator
2219/31264 . . . Control, autonomous self learn knowledge, rearrange task, reallocate resources
2219/31265 . . . Control process by combining history and real time data
2219/31266 . . . Convey, transport tool to workcenter, central tool storage
2219/31267 . . . Central tool storage, convey a whole tool drum, magazine to workcenter
2219/31268 . . . Central workpiece storage, convey workpiece, work pallet, holder to workcell
2219/31269 . . . Convey tool and workpiece to workcenter
2219/31271 . . . Priority workpiece pallet selected instead of routine workpiece pallet

2219/31272 . . . Avoid piling up, queue of workpieces, accommodate surges
2219/31273 . . . Buffer conveyor along main conveyor
2219/31274 . . . Convey products, move equipment according to production plan in memory
2219/31275 . . . Vehicle to convey workpieces is manually operable
2219/31276 . . . Transport a lot to stations, each with different types of manufacturing equipment
2219/31277 . . . Dispatching rules, shortest travel time or bidding based to reduce empty travel
2219/31278 . . . Store optimum number of workpiece, between max min, in bins, compartment, save travel time
2219/31279 . . . Prevent introduction of two pallets in same cell
2219/31281 . . . Calculate optimum path for conveying workpieces
2219/31282 . . . Data acquisition, BDE MDE
2219/31283 . . . Communication memory, storage, ram, eprom on workpiece or pallet
2219/31284 . . . Set begin and end of collection time for concerned machines, parameters
2219/31285 . . . Send required data to computer as function of specified condition
2219/31286 . . . Detect position of articles and equipment by receivers, identify objects by code
2219/31287 . . . Indicate output for data, screen or printer or database
2219/31288 . . . Archive collected data into history file
2219/31289 . . . Read card with operator and another card with process, product, work order info
2219/31291 . . . Store value detected signal and machine name and name of part of machine, mask
2219/31292 . . . Data in categories, each with a priority factor
2219/31293 . . . Enter size measurements, store in data base, analyze and identify in size data group
2219/31294 . . . Compare measurements from sensors to detect defective sensors
2219/31295 . . . Use integrated controller, processor during product, car assembly for ide, display, test
2219/31296 . . . Identification, pallet object data and program code for station
2219/31297 . . . Read only that ide information which is needed for specific operation
2219/31298 . . . Store on actual pallets also id of several other upstream, following pallets
2219/31299 . . . If workpiece rejected, write in id and erase operation code
2219/31301 . . . Restore lost id by using entry number of preceding, following pallet
2219/31302 . . . Verify id data and reread, rewrite or alarm on fault
2219/31303 . . . If workpiece transferred to other pallet, transfer also id
2219/31304 . . . Identification of workpiece and data for control, inspection, safety, calibration
2219/31305 . . . Robot arm identifies object during movement
2219/31306 . . . Read identification only if object is present
2219/31307 . . . Identification structure is partly a copy of operating structure
2219/31308 . . . Capture image asynchronously with processing of analysis, identification
2219/31309 . . . Identification workpiece and time limit for processing of workpiece
Data are id, destination, number of pieces, alternative destination, process data
Identify pallet, bag, box code
Measure weight, dimension and contents of box, tray
Store in workpiece detected defects
Use of data by host, send work order to operator after pallet detection
Output test result report after testing, inspection
Outputs delivery ordersheet, relating to finished products, to packing cell
Data analysis, using different formats like table, chart
Use data groups as inventory control value, adapt inventory need to new data
Print, output finished product documentation, manual using id of all workpieces assembled, processed
Work still to be done on workpiece
Database for CIM
Distributed real time knowledge, database
Machine selection support, use of database
Database to manage communication networks
Directory service for database
Objects report their location to directory service
Distributed, among several servers, directory service
Select manufacturing information by entering product number
Back order management with back order, part maker delivery, production databases
Database to backup and restore factory controllers
Database with devices, configuration, of plant
Database of address of devices registers in different networks, mapping
Store machines performance; use it to control future machining
Failure information database
Design, flexible manufacturing cell design
From parameters, build processes, select control elements and their connection
Design of factory information system
Design of process control system
Design of factory, manufacturing system control
Element, file server
Map backbone bus
Network manager
Communication adaptors between network and each machine
Gateway
Server node as operator panel, with display for lon
Expert system to select best suited machining centre
Expert system integrates knowledges to control workshop
Expert system to design cellular manufacturing systems
Hybrid expert, knowledge based system combined with ann
Fault, if one station defect, stop it, other stations take over
Automatic fault detection and isolation
Observer based fault detection, use model
Markov model
Object oriented model for fault, quality control
Verify if right controllers are connected to carrier, conveyor controller
Verify correct configuration of system
Action, if one station defect, execute special program for other stations
If one station defect, return other stations to original programmed modes
Send message to most appropriate operator as function of kind of error
Operate faulty tool in degraded mode
MMS manufacturing message specification, rs511, iso9506
MAP manufacturing automation protocol
Translation, conversion of protocol between two layers, networks
VMD virtual manufacturing device for robot task control, cell
Mes manufacturing execution system
You virtual operative organisational unit, extension of vmd
FAL fieldbus application layer, application service elements ase and application relations ar
LAS link active scheduler, distribute bandwidth between processing nodes
MFL material flow
From stored machine groups and relation machine workpiece, send workpiece to idle
Queue control
Master monitors controllers, updates production progress, allocates resources
Matrix cluster, machines in cell according to parts, row is part, column is machines
Find shortest way, route
Compare ratio of running work with optimum, decrease number of idle machines
Produce construction sequence, make parts, store, assemble equipment, ship
Determine rate of MFL out of each process within each workstation
Determine size of batch of material for each process to meet mfl rate
If resources, material, pieces under tolerance level, renew them until upper level
Just in time JIT, kanban is box to control flow of workpiece
Pull type, client order decides manufacturing
Administration tasks and factory control tasks
Lims laboratory information and management
Object oriented engineering data management
Field management, low level, instruments and controllers acting in real time
Process management, specification, process and production data, middle level
Business management, production, document, asset, regulatory management, high level
Display all processes together or select only degree of correlation

Display correlated data so as to represent the for other transactions

Display of several transactions, sub-displays

Zoom or pan display for flexible access to information

Icon display for quick access of detailed will as help diagnostic

Operator can select a graphical screen at his detected alarm signals

Determine which variables of the system to be monitored

Display position of different workpieces, tools in system

Display of operating conditions of machines, workcells, selected programs

Display jig, pallet number, status and clamp jig number

Graphical display of process as function of detected alarm signals

Operator can select a graphical screen at his will as help diagnostic

Graphical display of process

Fisheye view, sharp detailed view of main subject, rest much smaller, navigate

Icon display for quick access of detailed information

Zoom or pan display for flexible access to information

Display of several transactions, sub-displays for other transactions

Display correlated data so as to represent the degree of correlation

Display all processes together or select only one
Operator select part of process he wants to see, video image is displayed

Safety monitoring system, redundant display, print systems for process data

Verify working state of printers, displays, switch over if defect

Verify monitored data if valid or not by comparing with reference value

Operator confirms data if verified data is correct, otherwise amends data

Verify and update all related data in relational database

Operator till task planning

Computer assisted machining, signals guide operator to manual machine object

Operator interface, manual control at cell, if host fails or priority

Manual control at central control to control workcell, select pallet

Graphical, textual instructions, sheet for operator to resume process

Graphical, text operator instructions, synchronous with product distribution

Operator addresses machines to give commands or retrieve data

Operator is assisted by expert system for advice and delegation of tasks

Operator changes schedule, workload in allowed range by graphical interface

Optimal task allocation between operator and machine

Operator adapts manufacturing as function of sensed values

Operator must signify his continued attendance at the workstation

Operator marks processes, scheduler detects marks, releases control to operator

Augmented reality assists operator in maintenance, repair, programming, assembly, use of head mounted display with 2-D 3-D display and voice feedback, voice and gesture command

Optimize, process management, optimize production line

Minimize setup time of machines

Adapt real process as function of changing simulation model, changing for better results

Adapt process as function of results of quality measuring until maximum quality

Dynamic reconfiguration to maintain optimal design, fabrication, assembly

Energy management, balance and limit power to tools

Ordering, remote ordering, enter article and operations needed, create jobfile

Print label, instructions for operator and job code for machining parameters

Remote ordering, electronic selection article and fitting to form of client

Automatic marking of article

Order code follows article through all operations

Order, plan, execute, confirm end order, if unfeasible execute exception operation

Electronic catalog, to select material, resources, make lists with prices

Enter also delivery location, transport means, kind of truck

Use item and structure information

Salesman creates order, system answers back with price, estimated date

Send article design, needed material, packaging and shipping info to manufacturer

Electronic market, network broker

Compose, configure article and order

Enter data, values for custom made articles

Order picking

Client can develop programs, parts on remote server located by manufacturer

Send also testing program

Combine orders from different customers

Halting, initiating or resuming production of a product on order

Program, information flow

Shift workpiece and agv, carriage data in memory on advance to next station

Each machine knows sequence of pallets, each pallet knows sequence of operations

On detection workpiece code load program for workpiece from central

Workcell end instruction selects next workpiece with related program

Wait state between two successive machining steps

Store program data, manufacturing history on workpiece, shifts to next

Central control, modify program slave computers as function of production demand from host

Lookup table, identify job to be executed by master or slave

Adjust work parameter as function of other cell

Send request for object carry out to other cell

Identify workpiece, read status centrally, machine, adapt status centrally

Balance load of workstations by grouping tasks

Control cell as function of correlation between stored and detected machine state

Execute program as function of deviation from predicted state, result

Send code, data for workpiece to each workstation to be used, update data

Central controls modules grouped according to function

Set machines to new lot work, send them operation schedule, nc and handling data

Adapt speed of tool as function of deviation from target rate of workpieces

Production change over

Synchronise set points of processes

Central stores operation code in id and in concerned station

Change combinations of operation codes in station, id for flexibility

Execution at station only permitted if operation code of station and id equal
Use of multiple id to prepare program for station before pallet in station

Adaptive fuzzy controller, tunes itself as function of machine parameter variation

Distributed fuzzy controllers

If inspection needed, stop machining, execute separate inspection program

History of operation of each machine

Predict workpiece measurements from measurements of previous workpieces

Adjust feedback from previous processes as function of elapsed time

Batch control system

Calculate process end time, form batch of workpieces and transport to process

Use of common resources

Sub batch, machine, assemble only part of the whole batch

Planing, material requiring planning MRP, request

Alternative, variant operation planning, revision specification of product

Planning of configuration of product, based on components

Layout of factory, facility, cell, production system planning

Integrate process planning and job shop scheduling

Decentral planning, each plant involved takes part of global

Master production planning, highest level

Action and material and technology combined to manufacture product

Algorithm, genetic algorithm, evolution strategy

Heuristic algorithm, accept feasible solution and attempt to improve it

Search, adaptive, after each iteration some search directions are forbidden

Dedicated language for batch processing, enter number of workpieces

Text, menu driven editor for batch programming, phase sequence, parameters

Batch, recipe configuration for flexible batch control

Recipe programming for flexible batch

Batch programming using oop

CAPP computer aided machining and process planning

CASE based process planning, using older, known case

Select machine type

Select size of tool

Data extraction from geometric models for process planning

Calculate machining axis, best feasible orientation for machining

Calculate machining volumes for turning operations

Operative process planning

From order, production time divide into special and normal operations

Divide process into machining methods

Use of ms windows for automation, connected to mms manufacturing message system

Program hybrid system, part sequence, part continuous

Maple manufacturing application programming environment

Hyperlink, access to program modules and to hardware modules in www, web server, browser

Read identification of part and generate automatically manufacturing conditions

Gui graphical user interface

Select program for specified machine from library, file server

Use job graph

SFC shop floor control, to develop and build control system for factory

Commands from program of other controller cause recompilation of local program

Dynamic generation of web pages from program code

APC advanced process control applications

Web service oriented architecture for manufacturing and automation

Configure, connect, combine different program modules

Select hardware, devices at workstation, needed for, to be used at cell, node

Select at workstation control parameters for cell, node

Define type of I-O, analog, digital, pulse

Define device, module description using xml format file

Use css style sheets as control parameters

Define device description using dd files

Manual, enter identification, name workpiece and teach manufacturing data

Display parts, manufacturing conditions to enter conditions for selected part

Edit teach data to change operation parameters of workstations

Enter correction data at a station, also transmitted to all downstream stations

Display working condition data, real measured data and tolerance
Prepare teach data by selecting data from two tables as function of type of work
Inhibit further editing of entered parameters
Exchange data between user, cad, caq, nc, capp
Object, attribute for geometry, technology, function oop
Editor and library for objects
Each defined object has corresponding set of geometrical macros
Create a new object by combining existing objects
Object groups, for object replication, naming, messaging and retrieving
Each hardware unit together with its software forms one object
Object oriented control, programming
Tasks or control icons are linked to form a job
Indicate synchronisation tags on icons of tasks
Petrinet and procedural language combined
Convert petrinet to sequence program for cell and to control program for machine
Convert petrinet to ladder diagram
Generation and analysis of synthesis rules for petrinet
Stochastic pn, spn
Transform, convert operator goals and information into petri nets
Control petri net together with modeling petri net, cascaded
Table, memory table with identification code for all parts to be used
Memory table parts classification and working, manufacturing conditions
Table with correlation between part codes and part classification
Correspondence between manufacturing part list and design part list
Computer assisted quality surveyance, caq
Normal and correction transferline, transfer workpiece if fault
Quality control, monitor production tool with multiple sensors
Monitor production, assembly apparatus with multiple sensors
If state of tool, product deviates from standard, adjust system, feedback
Test cell
Compare time, quality, state of operators with threshold value
Calculate entropy, disorder
Teaching inspection data, pictures and criteria and apply them for inspection
Correlation between controlling parameters for influence on quality parameters
Teaching relation between controlling parameters and quality parameters
Compare between original solid model and measured manufactured object
Real time statistical process monitoring
After inspection create correction table with position, correction data
Ann, neural base quality management
Quality prediction
Feedforward quality control
Store audit, history of inspection, control and workpiece data into database
Inspection at different locations, stages of manufacturing
Feedforward inspection data for calibration, manufacturing next stage
If number of errors grow, augment sampling rate for testing
Build statistical model of past normal proces, compare with actual process
Integration and cooperation between processes
Effect of material constituents, components on product manufactured
Performance assurance; assure certain level of non-defective products
Use model error adapted to type of workpiece
Selection from a lot of workpieces to be inspected
Action upon failure value, send warning, caution message to terminal
Rearrange production line
Stop production line
Outputs new workorders to operators
If parameter out of tolerance reject product
If parameter out of tolerance during limited time, accept product on condition
Display on screen what fault and which tool and what order to repair fault
If detected shape not correct, simulate new machine, tool and adapt path
If machining not optimized, simulate new parameters and correct machining
Finish defect surfaces on workpiece
Sort workpieces as function of quality data
Slow down production after failure
Correlation between defect and measured parameters to find origin of defect
Fault, defect detection of origin of fault, defect of product
Fixture failure diagnosis, measure assembly, derive influence of fixture on error
Identify parameters with highest probability of failure
Randomize workpiece treatment order within lot to improve lot-to-lot comparisons
Computer assisted repair, maintenance of system components
On error detected by zone supervisor, maintenance of particular zone
Repair, rework of manufactured article
Repair fault product by replacing fault parts
Inspection and correction, repair station in one unit, correction data in memory
Inspection and correction, repair station are unit, correction data in memory
Selection from a lot of workpieces to be inspected
运维及数据管理产品用于制造过程的实时统计过程监控
后处理创建修正表与位置，修正数据
自动化生产过程监控，计算机辅助质量调查，cad列表和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
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在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
计算机辅助质量监控，cad和设计部件列表
制造部件表与制造条件的对应关系
部件分类和工作流程的memory表
petrinet和过程语言组合
在任务或控制图标的图标上指示同步标签
任务或控制图标形成一个作业
物料和工件传输线，传输线
several jobs wait in a cell with plural machines

Operator scheduling for load, unload, walk and gantry

Schedule of overhead material handlers, robot

For tool feeding schedule

started immediately when first is finished

Job, recipe cascading: no delay, next job is enters or last unit leaves processing

input buffer of next machine if conflicts

Decision of job pulling, select job to put in where job is to go

Decision of job dispatching, select job to

determine

Available parts, available materials

Dynamic throughput maximization

Priority orders

Waiting, queue time, buffer

Setup time

Normal and special order production lines for different types of workpiece

Scheduling production, machining, job shop

As a function of, change of machine operation

Work sequence, alternative sequence

Required time for work temperature control

Due dates, pieces must be ready, priority of dates, deadline

Tool replacement minimization

Resource, machine assignment preferences, actual and anticipated load

Flexibility, polyvalent machine, large buffers, permutation operations, alternative

Rearrange production line as function of operator rating

Work manhours, number of operators and work place

Afo products, their components to be manufactured, lot selective

Setup time

Waiting, queue time, buffer

Priority orders

Dynamic throughput maximization

Available parts, available materials

Decision, of job release, select job to be launched next in shop

Decision of job dispatching, select job to process next on each machine

Decision of next visiting machine selection, where job is to go

Decision of job pulling, select job to put in input buffer of next machine if conflicts

Event is triggered when first unit of first lot enters or last unit leaves processing

Job, recipe cascading: no delay, next job is started immediately when first is finished

For tool feeding schedule

Agy schedule integrated into cell schedule

Schedule of overhead material handlers, robot gantry

Operator scheduling for load, unload, walk and wait in a cell with plural machines

Single machine scheduling, one machine, several jobs

For a quick and slow production line

Machine scheduling, several machines, several jobs

Job shop, two, more operations may not occupy same machine simultaneously

Multi manipulator assembly cell

Monitoring items connected to certain different entities, activities

Medical, chemical, biological laboratory

Create daily or weekly production matrix

Determine number of components, start of their production, allocate processor

Task sequence optimization

Large, medium and fine schedule, with feedback from fine to large

Minimize work in progress, system at maximum productivity

Maximize throughput of cell

Production start time from order and production specification, satisfaction degree

If error search in a repair library, trained by operator, to correct schedule

Adaptive scheduling, feedback of actual process progress to adapt schedule

Designate at least two group of articles, first with priority, reschedule second

Divide job shop into number of workcenters

Simulate production, process stages, determine optimum scheduling rules

Each pallet has working plan, information and optimum scheduling rules

Convert program to fit rescheduled machine

Minimize flow time, tact, shortest processing, machining time

Fastest interrupt time, change jobs dynamically to fastest machine

Rules to make scheduling decisions

Last buffer first serve, lifo

Shortest, narrowest non full queue

Shortest remaining capacity

Shortest queue next

Largest imminent operation time

Shortest remaining processing time

Largest remaining processing time

Machine with least work

First buffer first serve, fifo

Smallest ratio for imminent processing time divided by total processing time

Smallest value of product of imminent processing time with total processing time

Shortest imminent operation time, part of machining time

Largest processing, machining time

Machines with least frequency of errors

Determine lot priority as function of sum of queue and processing time

Quality data determines optimum machine sequence selection, queuing rules

Object oriented scheduling, use machine, part, tool object and coordinator

Local scheduler, each machine own scheduler, independent from defective machines

Structure, fuzzy logic expert system scheduler
Display of petrinet, graph editing
Timed petrinet, timed event graph
token Petrinet
Petrinet, coloured, inhibitor arc, timed, object
modelisation & management
modeling environment for plant life cycle
Cape-mode computer aided plant enterprise
Quality control
Line performance evaluation
For resource planning
Simulate batch processing
products
Bulk manufacturing, handling dry or fluid
Modeling, simulating assembly operations
conveyor system fcs
Simulation of material handling, flexible
system fcs
Strain, stress of manual work, operator strain
Modeling, simulating assembly operations
Master production scheduling
Bulk manufacturing, handling dry or fluid
products
Batch job routing in operation overlapping
Simulate batch processing
For resource planning
Line performance evaluation
Parallel experimentation machines
Quality control
Cape-mode computer aided plant enterprise
modeling environment for plant life cycle
modellisation & management
Predict failure time by analysing history fault
logs of same machines in databases
Petrinet, coloured, inhibitor arc, timed, object
token Petrinet
Timed petrinet, timed event graph
Display of petrinet, graph editing

2219/32416 . . . Tool information for program to use and needed timing, adapt timing
2219/32417 . . . Minimize number of tools, only a specific machine can process certain operations
2219/32418 . . . Machine workload balance, same tools for pool of machines for same operations
2219/32419 . . . All tools available, each part can fully be processed on a single machine
2219/32421 . . . Tool management incorporated in kernel of nc control
2219/32422 . . . Tool management and database management
2219/32423 . . . Task planning
2219/32424 . . . Task flow editing
2219/33 . . . Director till display
2219/33001 . . . Director is the nc controller, computer
2219/33002 . . . Artificial intelligence AI, expert, knowledge, rule based system KBS
2219/33003 . . . Algorithm, hashing algorithm
2219/33004 . . . Manual control of manipulator, machine
2219/33005 . . . Manually but assisted by using sensors
2219/33006 . . . Ama allocation manual automatic work between machine, manipulator and man
2219/33007 . . . Automatically control, manually limited, operator can override control
2219/33008 . . . Operate manually only in defined, limited zone area
2219/33009 . . . ART adaptive resonance theory, place input patterns in clusters during learning
2219/33011 . . . Link between hidden and input layer is sigmoid, and between output is linear
2219/33012 . . . Kohonen network, single layer with neurons, associated with codebook vector
2219/33013 . . . Higher order multilayer artificial neural network ANN, input terms has square, cubic terms of input, output
2219/33014 . . . BAM bidirectional associative memory artificial neural network
2219/33015 . . . Time delay artificial neural network
2219/33016 . . . Pi sigma network, summing in hidden layers, product in output layer
2219/33017 . . . Local linear nested network, coarse at root, split up and build tree
2219/33018 . . . Adaline network, n inputs with n weights, sum, one output
2219/33019 . . . Lapart, two art with lateral priming connection between output and vigilance nodes
2219/33021 . . . Connect plural macrocircuits, neural network modules in a larger network
2219/33022 . . . One network for learned signal values, one network for unknown signal values
2219/33023 . . . Ann with single, only one output
2219/33024 . . . RAM artificial neural network, several lookup tables addressed by input section, output summed
2219/33025 . . . Recurrent artificial neural network
2219/33026 . . . Wavelet artificial neural network, wavelet orthogonal decomposition for artificial neural network approximation
2219/33027 . . . Artificial neural network controller
2219/33028 . . . Function, rbf radial basis function network, gaussian network
2219/33029 . . . ANNS artificial neural network with sigmoid function
2219/33031 . . . Spline membership function
2219/33032 . . . Learn by changing input weights as function of position error
2219/33033 . . . Identification neural controller copies weight to system neural controller
2219/33034 . . . Online learning, training
2219/33035 . . . Slow learning combined with fast learning artificial neural network, two time scale ann
2219/33036 . . . Error back propagation
2219/33037 . . . Learn parameters of network offline, not while controlling system
2219/33038 . . . Real time online learning, training, dynamic network
2219/33039 . . . Learn for different measurement types, create for each a neural net
2219/33041 . . . Structure optimization and learning of artificial neural network by genetic algorithm
2219/33042 . . . Non linear filtering, recursive least squares
2219/33043 . . . Extended kalman filter
2219/33044 . . . Supervised learning with second artificial neural network
2219/33045 . . . Selforganizing network
2219/33046 . . . Forward propagation error
2219/33047 . . . Dynamic node creation, increase internal nodes if error too large
2219/33048 . . . By using kd tree data structure and delaunay linear interpolation, triangulation
2219/33049 . . . Cooperative coaching, each controller has own minimum, switch to lowest
2219/33051 . . . BBC behavior based control, stand alone module, cognitive, independent agent
2219/33052 . . . Subsumption architecture, behavioral modules in layers, override older ones
2219/33053 . . . Modular hardware, software, easy modification, expansion, generic, oop
2219/33054 . . . Control agent, an active logical entity that can control logical objects
2219/33055 . . . Holon, agent executes task and cooperates with other, distributed control
2219/33056 . . . Reinforcement learning, agent acts, receives reward, emotion, action selective
2219/33057 . . . If no module available to execute task, adapt module and execute task
2219/33058 . . . Low level element designed for reliability, not for speed, only small task
2219/33059 . . . High level competence, system action module sam, configuration and task modules
2219/33061 . . . Behaviour fusion, each layer can influence other by suppression or amplification
2219/33062 . . . Self repair
2219/33063 . . . Generic coordination, master agent to data manager agent to tasks to active agent
2219/33064 . . . Manufacturing planning and control agent and domain blackboards
2219/33065 . . . Ontogenetic learning, agent learns and adapt its own behaviour
2219/33066 . . . Phylogenetic learning, group agents learn and adapts their behaviour
2219/33067 . . . HCP help based cooperation protocol, when to ask or give help from or to agent
2219/33068 . . . CCP coordination cooperation protocol, make optimal decisions with other agents
2219/33069 . . . Immune algorithm, agent distinguishes self and foreign, lymphocyte, antibody agent
Self sufficient, agent responsible for own energy, tools
Two layer agent for execution of tasks and for communication, coordination
Ion control agent has communication, database, suggestion, decision, action, detect
Calculation loop, first one slow changing value, then several quick varying values
Calculate only necessary, critical values, to speed up calculation
Optimize time by parallel execution of independent blocks by two processors
Calculation iterative, recursive
Error table, interpolate between two stored values to correct error
Table with functional, weighting coefficients, function
Parallel computing, pipeline
Data parallelism, one administrative process and many worker process
Clock for microprocessor synchronized with pulses from encoder
Clock for microprocessor synchronized with multiplexer
Real time calendar clock
Interrupt frequency as function of rating of servomotor or desired control frequency
Two clock, clock for software counter and calendar clock, synchronized
Clock
Two clock, one for sequence control, one for motion control, pulses
Two clock, one for controller and one for calibration
Using several selectable and settable dividers
Real time clock interface between serial I-O and processor
Send clock from pc board, via extension bus to PLL circuit on nc boards, to servo
External clock delivers interrupts for real time execution of programs
Use clock to control main spindle rotational speed
Variable ticks, align clocks, to synchronise cycles with other machine, robot
Several nc machines, dnc, cnc
Computer numerical control [CNC]; Software control [SWC]
Dnc, direct numerical control
Dnc and cnc combined
Object manager handles objects having own procedures, messages oop
Tasks, functions are distributed over different cpu
Identification of type of connected module, motor, panel
Configure I-O by using logical and physical address
Designate each actuator by a name and corresponding operations
Exchange of type of controller is easy, before operation, adapt control to type
Select out of plurality of alternative control parameters
Graphic configuration control, connect pictures, objects to each other
Configuration software for network
Initialise each drive during start, load data to drive and image to controller
Configure motion controller to drive any kind of motor type connected
Group functions
Configuration of motion control
Define function by user programmable basic operations
Identify bus, interface select automatic adaption for bus, interface
Servo parameters in memory, configuration of control parameters
Host loads program from attached module to control that module
Adapt nc control to type of machine, read machine and measuring parameters
Identify kind of transducer, encoder used
Configuration of different kind of tool magazines, tool changers and buffers
System configuration, reconfiguration, customization, automatic
Identification of address connected module, processor
Display each control parameter by name and its value
Different spindles, axis controlled by configured paths, channel
Group spindles, axis into motion groups, nc channel structure
Synthesize programmable axis, to simulate a non existing, virtual axis
Configured function disabled if concerned axis not referenced
For each action define function for compensation, enter parameters
Enter parameters for relationship between axis
Data compression before sending data to allow control of more axis, spindles
Com: communication, inter processor communication, either local or network
Time left during polling used for other communication, priority for polling
Control program and communication are totally separated
Design of industrial communication system with expert system
Communication system software module independent from medium, protocol, address
Address switches on each controller, peripheral are set by operator
Position of module in ring, loop determines address of module
Module clock, synchronised by controller message, to send message in time slice
Count clock pulses to determine address of node, module
Each node occupies in address space a length equal to number of bits to be exchanged
Address peripheral, controller
CLS client server architecture, client consumes, server provides services
Publishers subscriber, publisher, master broadcasts data to slaves, subscriber

Server has organisation, tree data to access user data, client sends also both

AR application relationship, cooperation through logical links

Data exchange between processors of different axis of same or different cnc

Communication between motor current controller and position controller

Communication between two processors over shared, dualport ram

Between processor and sensor, encoder

Remote procedure call to each other

Communication between acyclic and cyclic, loop programs

Data exchange between controller and processors

Two bus, high speed and low speed bus, linked or not

Multichannel master bus

Bus timing adjustment by buffer with controller

Gpsc gp general purpose serial channel, link

Rs485 bus to control several modules, motors

Bus arbitration, switch computer to different memory

Two bus, master bus and local servo bus

Name of bus, vme-bus

Sdbus

Multibus

Bitbus

Sds smart distributed system, honeywell

Isa bus

Rs485, mpi multipoint, multidrop interface

Interface, scsi, parallel

Centronics

Pcmcia

Isdn

Uart, serial datatransmission, modem

IEEE-488, hp interface, instrumentation

Rs232c to rs485 converter

Rs232c switch box, break out box, to connect different devices

Circuit for signal adaption, voltage level shift, filter noise

Serial transmission rs232c, rs422, rs485 communication link

Twisted pair

Optical, glass fiber

Data exchange combined with inductively coupled power supply

Radio link, wireless

Inductive transmission of measured values

Data and power supplied over optical fiber

Wave guide, also used as rails for movable station

Data and power each on a different line to all peripheral, bus

Current loop 4-20-mA milliamperere

Laser, light link, infrared

Transponder

Twisted pair combined with optical fiber for critical emc zones

Single serial line, virtual second line is earth

Wireless transmission of power and data, inductively, rotary transformer

Optocoupler, galvanic separation, isolation

Coax or optical fiber or twisted pair

Ultrasonic

Physical means, radio, infra red, ultrasonic, inductive link

Superposition of control signals on supply lines

Protocol, mailbox, email, mail system

Polling

Processor for communication with, evaluation of signals form detector to pe

Communication cpu to synchronize axis between different machines

Bus between different axis controllers and cpu

Synchronization pulses on bus for axis controllers

Operational, real time for system, and service for configuration is non real time

Continuity communication controlled by client

Motor encoders, resolvers on common bus with drives, servo controllers

Drives, servo units, main control on internal net, lan, ethernet, tcp-ip, wireless

Drives, servo units, sensors, motors, on local network, ethernet, tcp-ip, wireless

High speed serial link combined with medium speed serial link

Serial ring, loop pam programmable axis manager

Several serial channels, each provided with d-a to terminals of servomotor

Interface nc machine to data server

Daisy chain

Safety, echo back to verify correctness message

Detection of line failure, breakage of transmission, failure of receiver

Differential amplifier, xor to cancel noise, balanced rs422

Decoupling, to avoid noise, crosstalk between wires of bus

Detect, respond to lost message

If servo data corrupt, use previous value, no repeat

Detect bad data transfer

Redundant communication channels, processors and signal processing hardware

Add check data to message to check faulty communication

Detect short circuit of bus

Switch from differential to single line communication if short between two wires

Switch off, stop, halt transmission on detection of fault

Compare results from two masters on two busses, if not equal shut down machines

Watchdog for datacommunication, on error switch off supply to bus modules

Detect quality of received data, message

Packet information exchange
Autosend, send information from cad station automatically to peripheral
Timing of transmission data to peripheral
Synchronize transfer, take over, change of parameters and reference values
Time window for each controller or controlled function
Compress, pack data before transmission
Schedule periodic and aperiodic traffic, real time, time critical
Real time synchronous transmission, model
Correction data transmission errors, protection against noise, twisted pair
Serial position feedback, serial to parallel conversion and reverse
Transfer of data parallel
Resolver to digital conversion
Conversion of designed 3-D tolerance, allowance to real coordinates of machine
Common coordinate conversion for multiple heads, spindles
Conversion of measuring robot coordinates to workpiece coordinates
Conversion of detected pulses to voltage, frequency to voltage converter
Current to voltage conversion
Conversion, transformation of coordinates, cartesian or polar
Conversion of angle between links to linear displacement of actuator
Conversion of voltage, resistance to pulses
Pulse to frequency conversion, frequency to pulse
Pneumatic, air to hydraulic conversion
D-A, A-D
Convert cartesian to machine coordinates
Convert workpiece to machine coordinates
Conversion, transformation of data before and after interpolator
DCS distributed, decentralised control system, multiprocessor
Integrated communication and control, transmission delay, sampling rate effect
Distributed, decision made by negotiation among executive components, execute it
Decentralized, each component makes own decision, executes only own decision
Distributed system with host as leader, host with multiple of agents
Cooperation between autonomous modules by receipts, messages, no synchronisation
Expansion by using secondary access to each module, extension module
Architecture, nodes for communication and measuring on serial bus
Node with communication, transducer, common core, application specific modules
Customized nodes for desired functionality
Remote diagnostic
Diagnostic
Test, simulation analyser
Program panel to program, enter data for diagnostic
Switch, select between normal and diagnostic control program
During diagnostic of servocontroller, motor is isolated
Logic analyse function of cnc
Storage oscilloscope function of cnc to diagnose servo drive, axis oscilloscope
For each actuated axis, set a bit in a word in memory, state of axis in word
Nc in case of propagation error, search previous module, origin of error
Fuzzy expert system for diagnostic, monitoring
ANN for diagnostic, monitoring
Diagnostic, test, debug
Remote videoconferencing
Real time, online diagnostic, integrated in normal control system
Simulation during machining
Different sets of monitoring parameters for each operation mode
Expert system for diagnostic, monitoring use of tree and probability
Display of diagnostic
Display of relevant errors together with time mark
Configuration file to set how data will be displayed
On error, failure, fault automatically search and dial maintenance person
If error message not clear, search help by index of message vocabulary
Error recovery, automated error recovery
System code for error recovery
Operator selects action, system stores state, zero based error state
Failure reason analysis, simple strategy or multiple outcome analysis
Failure detection and reconfiguration
On the fly software replacement on error
Alternative strategy driver revises control behaviour
Knowledge acquisition
Interference justification network
Observation learning
Failure driven learning
Self diagnostic of boards, own test program
What to diagnose, whole system, test, simulate
Diagnostic of only machining, operation
Analyzer, diagnostic for servovalve
Self diagnostic of control system, servo system
Diagnostic for bus system of computer
Measuring system, encoder
Test, diagnostic of field device for correct device, correct parameters
Each processor can execute all programs
Network multiprocessing
Load balancing, distribution between processors
Microprocessor for max 3-D control otherwise host takes over for more axis
2219/33336 . . . first dsp calculates commands for each motor, second dsp regulates position
2219/33337 . . . For each axis a processor, microprocessor
2219/33338 . . . DNC distributed, decentralised nc, concurrent, multiprocessing
2219/33339 . . . Controller with lowest operation rate is selected as master
2219/33341 . . . Peer to peer, change master if overloaded
2219/33342 . . . Master slave, supervisor, front end and slave processor, hierarchical structure
2219/33343 . . . Each slave stores communication program to be used by master, exchangeability
2219/33344 . . . Each slave has several processors operating in parallel
2219/33345 . . . Several master modules, connection modules and slave modules
2219/33346 . . . Only memory of master module stores all position programs of slaves
2219/33347 . . . Master sends servo address, speed, kind of interpolation to slave
2219/33348 . . . Processor adapts signals to connected display
2219/34 . . . Director, elements to supervisory
2219/34001 . . . PLL phase locked loop
2219/34002 . . . Analog multiplexer
2219/34003 . . . Tri state driver
2219/34004 . . . Shift register
2219/34005 . . . Motion control chip, contains digital filter as control compensator
2219/34006 . . . Fifo
2219/34007 . . . Neuromine, input pulse train, can be inhibited or excited, output TTL, neuron
2219/34008 . . . Asic application specific integrated circuit, single chip microcontroller
2219/34009 . . . Coprocessor
2219/34011 . . . MMU
2219/34012 . . . Smart, intelligent I-O coprocessor, programmable sensor interface
2219/34013 . . . Servocontroller
2219/34014 . . . Sample hold circuit
2219/34015 . . . Axis controller
2219/34016 . . . Pulse processor
2219/34017 . . . Vector processor
2219/34018 . . . Forth controller
2219/34019 . . . Array of processors, parallel computing
2219/34021 . . . Dsp digital sensor signal processor
2219/34022 . . . Dcasp digital controlled analog signal processor
2219/34023 . . . Risc processor
2219/34024 . . . Fpga fieldprogrammable gate arrays
2219/34025 . . . Polynomial analysis
2219/34026 . . . Fpga programmable gate array
2219/34027 . . . Dual servo controller, for two motors
2219/34028 . . . Hold relay
2219/34029 . . . Pam programmable axis controller, to control large number of axis
2219/34031 . . . Synchronous detector
2219/34032 . . . Asic and microcontroller cooperate
2219/34033 . . . Control processor and signal processor cooperate
2219/34034 . . . Multiplier, prm, brm
2219/34035 . . . Time relay
2219/34036 . . . Saturable reactor
2219/34037 . . . Brm followed by postprocessor to smooth curve
2219/34038 . . . Web, http, ftp, internet, intranet server
2219/34039 . . . Access central database through internet
2219/34041 . . . Dda
2219/34042 . . . Filter
2219/34043 . . . Delay line
2219/34044 . . . Mathematical coprocessor - processor
2219/34045 . . . Timer
2219/34046 . . . Analog multiplier
2219/34047 . . . Dsp digital signal processor
2219/34048 . . . Fourier transformation, analysis, fft
2219/34049 . . . Adder
2219/34051 . . . Bcd
2219/34052 . . . Software counter
2219/34053 . . . Counters, tellers
2219/34054 . . . Half serial half parallel
2219/34055 . . . Correction 3-excesscode
2219/34056 . . . Nine complement
2219/34057 . . . Complement
2219/34058 . . . Up-down
2219/34059 . . . Preset counter
2219/34061 . . . One counter per axis to unload cpu
2219/34062 . . . Comparator
2219/34063 . . . Bcd
2219/34064 . . . N+1 comparator
2219/34065 . . . Fuzzy logic, controller
2219/34066 . . . Fuzzy neural, neuro fuzzy network
2219/34067 . . . Multilayer fuzzy controller, execution and supervisor layer
2219/34068 . . . Fuzzy neural petri controller
2219/34069 . . . Shared memory
2219/34071 . . . Content addressable memory
2219/34072 . . . Non volatile memory, core memory
2219/34073 . . . Backup battery
2219/34074 . . . Associative memory
2219/34075 . . . Cognitive memory
2219/34076 . . . Shared, common or dual port memory, ram
2219/34077 . . . Fuzzy, rules are function of material, tool used
2219/34078 . . . Membership functions as parameters for shape pattern
2219/34079 . . . Extract only rules needed to obtain result
2219/34081 . . . Fuzzy art map neural network, one art for input map, lookup table, other for output
2219/34082 . . . Learning, online reinforcement learning
2219/34083 . . . Interpolation general
2219/34084 . . . Software interpolator using microprocessor
2219/34085 . . . Software interpolator
2219/34086 . . . At fixed periods pulses from table drive plural axis in unison
2219/34087 . . . Enter at fixed periods distances in counter for each axis, pulse distribution
2219/34088 . . . Chamfer, corner shape calculation
2219/34089 . . . Parametric, polynomial representation of path per axis as function of time
2219/34091 . . . Interpolate backwards
2219/34092 . . . Polar interpolation
2219/34093 . . . Real time toolpath generation, no need for large memory to store values
2219/34094 . . . Library with different kind of interpolation curves
2219/34095 . . . Look ahead segment calculation
Approximate, replace curve, surface with circle, linear segments, least error
Calculate movement from part program offline, calculate axis references online
Slope fitting, fairing contour, curve fitting, transition
Extrapolation
Data compression, look ahead segment calculation, max segment length
OCI on line interpolation
Taking planar slices from a 3-D shape
Postprocessor coarse fine
Area pocket machining, space filling curve, to cover whole surface
Using spiral collapsed boundary, contour parallel machining
Zigzag workpiece parallel sweeps, direction parallel machining
Using zigzag isoparametric parallel sweeps
Using spiral bounded boundary
Using hilbert curves, fractals, only visible points of patches taken
TSP traveling sales problem, SOM self-organizing map for tool path
Determine centerline, medial axis and branches in shape
Construct concentric polygons
Area, pocket machining for area with partially open boundary
Machine workpiece along, parallel to smallest side, dimension
Machine workpiece along, parallel to largest dimension
Using a pseudo-random or random tool path
Function generator, filter after interpolator to control position error
Edge generator
Function, profile generator
Sine cosine generator
Cordic processing
Sum squares
Overlap of counted axis pulses to servo
Brm followed by postprocessor to smooth curve
General surface replaced by sphere, cylinder, toroid, calculate quickly
Approximation for calculation
Split in approximation and accurate calculation
Choosing largest, major coordinate axis
Choosing slowest axis
Choose optimal coordinate system
Spline
Helicoidal
Cubic interpolation
Parabolic interpolation
B-spline, NURBS non uniform rational b-spline
Polynomial
Approximate corner by polynomial
Involute, evolute
Bezier interpolation, spline
Helical, spiral interpolation
Epitrochoid
Coons interpolation, patch
Circular interpolation
Analog
Circular interpolation in space, on arbitrary planes
Linear interpolation
Analog
Third degree
Slope control, delta x, y proportional to x, y
Synchronize interpolation of different axis boards, simultaneous start
Tangents form curve
Delta theta
Superposition curves, combine xy slides with other xy or polar slides
Linear in one axis, circular in other axis
Rotate a segment
Superposition manual control pulses on motion control pulses
4-D via 2-D+2-D
Select between rectangular and polar controller, interpolator
Coarse fine, macro microinterpolation, preprocessor
External interpolation
Coarse interpolator, path calculator delivers position, speed, acceleration blocks
Generate polynomial fitting in tolerance zone around polygon
Of the two or three axis, only one or two are controlled as function of tangent to other axis, plane
Switch between involute, circular and linear interpolation
Rotate segment over a certain angle
Overlap, between two blocks, continuous, smooth speed change, movement
Block segments, find next point on next segment by cross point circle and segment
Calculate for different inclined segments stitch points evenly distributed
Simulated pulse for better resolution
Variable interpolation speed or resolution
Adapt resolution as function of machining load, in corner, to keep constant surface speed
Variable resolution
Window path, contour of rectangle
Straight cut
Following line+circle
Degree line
Any angle, slope
Safety, stop, slowdown interpolator if speed, position, torque error too large
On each axis, for each block, a software limit switch, for safe slow down
Pneumatic
Memory management
Memory refresh
Bank switching, ping-pong memory for communication between processors
Part program in consecutive memory blocks, each with spare space for corrections
Memory management, dma direct memory access
Search blank memory space to load program, storage, memory allocation
Electric and fluidic modules integrated on one substrate
Module with low maintenance connected to removable module with high maintenance
Each module uses functions of a real time kernel
Reusable software, generic resource model library
Module has a general, high level and a specific, proprietary part
Independent units, stackthrough in cabinet, no backplane
Modular construction, plug-in module, lsi module
Motion controller independent from nc, lmc local motor controller
Array vlsi processor
Motion controller
Microprocessor only for display
Microprocessor only for hand control
Microprocessor only for mdi, control panel
Same microprocessor for data input and for servocontrol
I-apx-432 processor
Microprocessor
Programmable motion controller
Microprocessor with build in pwm
Transputer
Special interface, peripheral to motor
Computer delivers control pulses from table directly to motors
Computer sends displacement and selected device to output register
Combined input output module, single module
Select appropriate interface, according to kind of tool or other detection
Interface board for measuring system, for resolver, encoder or interfometer
Select address of motor, control serial switches in power supply ring
Alterable connecter board between controller and machine
Counter takes over measuring and pwm task from microprocessor
SIU serial interface unit takes over communication task from microprocessor
Interface controls either dc, ac or step motors
Test with microcomputer self
Multiplexed subsystem stores state of controlling microprocessor on switch off
Each subsystem has own interrupt which is switched on during multiplex
Control order of multiplexed axis
Multiplex for servos, actuators
Multiplexed d-a a-d
Hydraulic multiplexer
Multiplex for whole system
For reading data only
For measurement only
Single feedback sensor, transducer for plurality, one at a time, driven tools
Multiplex for control only
Address several motors, each with its own identification
OOC object oriented control
Machining objects are hierarchically organised
Machining object comprises a slide, a palet, workpieces, machining, a contour
Sub divide machining object in machining groups, geometry, start point, special
Cnc works with different operating systems, windows, os-2, vms in parallel
OSY operating system
Unix
Operating system controls selection and execution of program modules
Msdos
Api application programming interface
OS-2
Real time system, qnx, works together with non real time system, windows nt
Common language run time CLR, MS-NET, DOTNET, java run time environment
Windows, microsoft windows
DDE direct data exchange, DLL dynamic library linking
OLE object linking and embedding, OPC ole for process control
Odbc open database connectivity
Windows nt, windows-2000
Windows-95
Windows nt and cooperating real time extension
Cnc and pic controlled alternately by same processor, using timer
Programmable computer controller, plc implemented with pc
Nc integrated into pic, plc, combination of commands
Communication pc and nc, pic over file system of pc, direct access pc to nc, pic
Pc and plc and nc integrated, pcnc concept
Connect pc card to industrial bus, with additional timing and adapting logic
Windows file server to control pc hosted boards under ms windows
Pc has priority over cnc controller
Pc bypasses robot controller processor, access directly encoders, amplifiers
Motion control board, card, in pc
Pc, personal computer as controller
Osaca open system architecture for control in automation, ucmc universal machine control
Using special api's allowing user access to control machine, motion, servo
Using windows nt for general control and real time unix for motion, plc control
Using an operator console and a motion chassis connected by network
Open system architecture, in general
Intelligent positioning I-O
Plc and motion controller combined
Plc as main controller for cnc
Plc as motion controller combined and plc for work type dependant data, parameter
Programmable interface, pic, plc
Filtering noise I-O
Image table
Diagnostic, locate failures
System, logic analyser, simulation
Level conversion
Analog input, comparator delivers interrupt
Memory with I-O and pointer, external I-O with map, edit map, pointer to adapt I-O
Nc system has direct access to I-O of pic, plc
Plc controls movement via nc, no direct interface to servo
PNC is plc, pic and nc cooperation
Pc as input, edit device for plc
Connect, disconnect host computer by sleep command from local pc
Power down, energy saving
On nc power on or off, synchronize power on or off of displays with own supply
Power supply sets relay switch, allows push button or automatic switch on off nc
Dual power supply, for digital circuit and for analog signals
Energy saving by recuperating braking, deceleration energy
Power supply for servo delivered by, derived from 4-20-mA current loop
Power supply for communication delivered by, derived from 4-20-mA current loop
Slow down, limit speed for energy saving
Power supply turning on or shutting off
Install nc system, check voltages, power supply with incorporated a-d
Execute same program on different machines by differently addressing axis
Verify if workpiece is already machined, by its weight
Sequence as function of nc controlled axis position, axis zone
Database for control of a single machine
Initialize execution program at reference position on workpiece
Commanding different axis in sequential order as function of direction of movement
Switch some axis over to manual control, while other stay automatic
Speed up, optimize execution by combining instructions belonging together
Program controls two operations simultaneously in opposite directions
Modify, adapt system response to signals from process
Cueing commands table
Generate extended plc program during machining, execution of nc program
First processor filters instructions for indexing only, all other instructions for second controller
Program execution as function of direction, forward or backward
Multi threading
Scalability
First look ahead for acyclic execution, followed by cyclic execution
Avoid deadlock, lock-up
Manual to automatic, tracer
Execute control tasks, programs as well as user, application programs
Single step execution of program
Choose between electronic cam or time-dependent as function of required machining accuracy
Matching closest patterns stored in database with actual components
Generation of electronic cam data from nc program
Standby commands, let proces wait while program controls other process
Database for sequential control of several machines by messages
User program fetches part of system program when flags are set and detected
Execute auxiliary function, tool change, while concurrent machining
Coordination of operations, different machines, robots execute different tasks
Proper allocation of control components to the required task
Knowledge acquisition of environment
Explore discrete event properties, reliability, parallelism, availability
Independent positioning motor controlled by microprocessor only if event, limit, pulse passed
DES discrete event system, deds discrete event dynamic system
List of failure events, list of actions, events, trigger actions
Compensation variable interrupt execution delay, interrupt jitter
Interrupt driven message passing network
Interrupt changed to uninterruptable interrupt
Real time based interrupt to control axis, other function
Mask for interrupts, inhibit during more important tasks
Sampling interrupt is product of integer times scheduler interrupt
Encoder generates interrupt to synchronize closed loop
Delay interpolation interrupt as function of machining rates and feeds of machine groups
After interrupt of operation, do other task and go on - resume operation
Interpolation interrupt so as to avoid fractions of command pulses
Interrupts, different tasks foreground, midground, background
Priority
Cause of interrupt is sensor and actuator failure
Abrupt change in system dynamics
2219/34372 . . . Inability to process, execute assigned task within allocated time interval
2219/34373 . . . Actuator overloading
2219/34374 . . . False alarm states
2219/34375 . . . Generate interrupt after a certain number of position, counter pulses
2219/34376 . . . Management nc programs, files
2219/34377 . . . Selection out of several databases according to workpiece or conditions
2219/34378 . . . Erase plural programs in a single operation
2219/34379 . . . Job management
2219/34381 . . . Multitasking
2219/34382 . . . Preemptive multitasking, cpu decides upon priority scheme, which task to start
2219/34383 . . . Dynamic preemptive, special event register manages time slices for applications
2219/34384 . . . Execute next block after predetermined time
2219/34385 . . . Execute next block if largest axis distance is reached
2219/34386 . . . Advance program without M function completion signal
2219/34387 . . . Delay command as function of speed
2219/34388 . . . Detect correct moment, position, advanced, delayed, then next command
2219/34389 . . . After rough plunge grinding, initiate backoff grinding as function of delay wheel position
2219/34391 . . . Synchronize axis movement and tool action, delay action, simulation inertia
2219/34392 . . . Stop program on detection of undefined variable, symbol, enter definition, continue
2219/34393 . . . Stop program if needed workpiece, tool or data lacks, misses
2219/34394 . . . Execute a certain number of program blocks and stop
2219/34395 . . . Synchronize between panel and control
2219/34396 . . . Control different groups of functions, commands simultaneously, synchronized
2219/34397 . . . Synchronize manipulators and machine by using a reference clock for all
2219/34398 . . . Channel stops and waits for marker until other channel puts that marker
2219/34399 . . . Switch between synchronous and asynchronous mode of controllers
2219/34401 . . . Synchronize position controller drive with interpolator
2219/34402 . . . Synchronize programs for machines, processes, tasks, if one stops other also
2219/34403 . . . RTI real time, kernel, processing
2219/34404 . . . Allocate storage, memory in each processor for a copy of needed data
2219/34405 . . . Switch register banks, each storing process states, for quick real time execution
2219/34406 . . . Effect of computer, communication delay in real time control
2219/34407 . . . Calculate elapsed time, store in counter, start task when time elapsed
2219/34408 . . . Design real time control system
2219/34409 . . . Rnos real time networked operating system
2219/34411 . . . Handling time critical and time non critical program sequences
2219/34412 . . . Mark some sequences of time non critical sequences as locked, non interruptable
2219/34413 . . . Add time stamp to command message
2219/34414 . . . Maximize utilisation workstation
2219/34415 . . . Execute urgent jobs quickly
2219/34416 . . . Examine, analyse sensor data for co-exclusion sets, memorize, correlate actions
2219/34417 . . . Multiprocessor scheduling
2219/34418 . . . Scheduler for sequential control, task planning, control sequence
2219/34419 . . . Structure of control system
2219/34421 . . . Termination for each device, enables easy insertion, connection or disconnection
2219/34422 . . . Sbc single board computer
2219/34423 . . . Optical isolation, galvanic isolation
2219/34424 . . . Data flow architecture
2219/34425 . . . Same microprocessor for programming and for machine control
2219/34426 . . . Same hardware, servo controller for different control modes
2219/34427 . . . Diagnostic, monitoring incorporated in controller
2219/34428 . . . LSI
2219/34429 . . . Servo controller near main cpu but remote from servomotor, integrated in cnc
2219/34431 . . . Main uninterruptable servo loop processor and interruptable servo event processor
2219/34432 . . . Speed and current control integrated into nc control system
2219/34433 . . . Multitask processor controls real time processor via communication memory
2219/34434 . . . Separate power controller for drive, servodrive, one per axis, connected to cnc
2219/34435 . . . Position encoder and motor connection in one interface between motor and microprocessor
2219/34436 . . . Interface circuit build into connector, dongle
2219/34437 . . . Parallel processing of functions, each layer has own sample rate
2219/34438 . . . Panel connected to nc by means of switch matrixes
2219/34439 . . . One cable between controller and amplifier, two between amplifier and motor
2219/34441 . . . Common communication interface for panel and remote i-o
2219/34442 . . . Control unit serves also to match drive motor to power supply
2219/34443 . . . Sensors and actuator integrated into tool
2219/34444 . . . Web control system, with intelligent control components each with web server
2219/34445 . . . Several power modules for same actuator, motor
2219/34446 . . . No change of operation mode when slave axis is out of synchronisation
2219/34447 . . . A microprocessor for programming and a microprocessor for control execution of program
2219/34448 . . . Integrated servo control circuit fixed to housing, remote from cpu
2219/34449 . . . Fault tolerant control, task from one microprocessor can be done by other
2219/34451 . . . False alarm states evaluation, threshold to verify correctness alarm
2219/34452 . . . Synchronize control with pulse, if loss, excess, error, then stop
2219/34453 . . . Stop spreading, propagation failure through system, inhibit drivers defect boards
2219/34454 . . . Check functioning controller, cpu or program
Different parameters are evaluated to indicate different faults
Authorize control of machine, robot if control panel has been connected
Emit alarm signal
Inhibit start or related control switches if path boundary is outside limits
Plausibility check on connection of module, control unit to machine
Inhibit access to area if dangerous, cover taken off
Interlock, stop motor if microprocessor starts interrupt, because no watchdog pulse from microprocessor
Alarm canceled automatically when program corrected
Adaptive threshold, level for alarm, eliminate false alarm
Safety, control of correct operation, abnormal states
Bad circuits, watchdog, alarm, indication
Try again program
Check memory by storing beforehand complement of expected result
Normally messages over network, if failure, messages from operator over I-O
Program memory is inhibited, not accessible as long as power fails
Configure alterable memory as read only, to avoid erasing
Inhibit control until control lever is first set to neutral position
Sense voltage drop of system, shut down servo
Detect abnormality of control system without inverted model, using input command
Local control predicts next command data from past stored data if host control fails
Fault prediction, analyzing signal trends
Urgent safety signals treated with hardware; others with software
Flush enclosure of circuit with air, keep clean air over pressure
EFC explosion free control, intrinsically safe
Redundancy, processors watch each other for correctness
Monitor absolute position independently by two processors, if out of range
Use dual channels
Same function code, program is fully used in normal and abnormal case
Monitor axis movement, speed, independently by two processors, if out of range
Redundant diagnostic controllers watch redundant process controllers
One computer, controller replaces other, backup computer
Watchdog with adaptive timeout as function of speed of motor
Count certain number of faults before delivering alarm or stop
Time out, decide only after a lapse, period of time
Supervision, display diagnostic, use or select between different stored screen
Display machining time and real time clock to control machining time
Nc in input of data, input till input file format
Data input, data handling, programming, monitoring of nc
Parametric machine control, direct control from cad data, no nc data
Kad kam knowledge aided design, knowledge aided manufacturing
Mechanical design and electronic design integrated
Sheet metal cad
Object oriented design
Cad makes template of tool as function of spindle, machine tool and set on spindle
Www cad, world wide design and manufacturing
Dynamic simulation
Use of spreadsheet
Cad cam
Define workpiece, dimension from characteristics, strength, performance
From design, calculate additional parameters, for strength
Calculate production compensation, heat shrinkage, overetching
Analyse model, decide on number of sections to take
Finite elements analysis, finite elements method FEM
Determining bending die radius from part data, estimated radius and calculation
From product constraints select optimum process out of plurality of DTM means
Identify object characteristics, elasticity, density, hardness and select material
Calculate gear dimensions, tooth surfaces for optimum contact
Constraint based modeling, tooth surfaces for optimum contact
Incremental constraint solving, keep relationships between elements
Increase constraint solving, keep relationships between elements
Design and manufacture jig
Design of machine tool, of cnc machine
Design for assembly DFA, ease of object assembly
Adapt design as function of manufacturing merits, features, for manufacturing, DFM
Design of modular control system
Redesign, use former design
Check correctness, violation of design, rule check
Reliability by design, error free object
Adapt design to customer feedback
Design gear, tooth surfaces
Correct model by comparing 3-D measured data of modified workpiece with original model
Use medial axis transformation to decompose a domain, limits combinations
Combine, superpose model, foot data with style data
Model for analysis of workpiece displacement due to clamping, fixture
2219/35041 . . . Genetic algorithm for selforganizing designs
2219/35042 . . . Add finishing allowances to a cutter path
2219/35043 . . . Tool, fixture design
2219/35044 . . . Tool, design of tool, mold, die tooling
2219/35045 . . . Design tool for minimal tool change
2219/35046 . . . Design tool to minimize manufacturing, machining time
2219/35047 . . . Design tools in pairs, to be used together
2219/35048 . . . Recognition of punch shapes provided in die component catalogue
2219/35049 . . . BCL binary cutter location, rs494 standard CL format
2219/35051 . . . Data exchange between cad systems, cad and cam
2219/35052 . . . High level language conversion program, DXF format to nc format
2219/35053 . . . IGES initial graphics exchange specification
2219/35054 . . . STEP or PDES, standard for exchange of product data, form or surface data
2219/35055 . . . Data modeling language
2219/35056 . . . Manual entry of source, destination, data, format to be used for transfer
2219/35057 . . . Create also operation data concerning operating device
2219/35058 . . . Block cyclus time, time to prepare a block of data to be sent to machine
2219/35059 . . . Convert pcb design data to control data for surface mounting machine
2219/35061 . . . From cad make drawing with text for dimensions, scan it and read dimensions
2219/35062 . . . Derive mating, complementary, mirror part from computer model data
2219/35063 . . . Geometrical transformation of image
2219/35064 . . . Transform sketch by replacing free curves with mathematical curves, two display
2219/35065 . . . Undo part of design
2219/35066 . . . Modify design, modify shape, stretch, scale, add, delete
2219/35067 . . . Parametric function, group of lines, curves, change one, all change
2219/35068 . . . Command files, subroutines for drawing
2219/35069 . . . Derive missing surface from mirror part of computer model
2219/35071 . . . Drawing function, rotate designed figure, rotation
2219/35072 . . . Scale, zoom a designed figure
2219/35073 . . . Copy, duplicate a designed figure
2219/35074 . . . Display object, recognition of geometric forms
2219/35075 . . . Display picture of scanned object together with picture of cad object, combine
2219/35076 . . . Display from bottom or top side, adjust drawing lines, visible or not
2219/35077 . . . Display part and patterns to be machined on part, make selection
2219/35078 . . . Do not load non necessary or obstructive parts of drawing, remove from screen
2219/35079 . . . Features, functions like special relationship, assembly locations
2219/35081 . . . Product design and process machining planning concurrently, machining as function of design
2219/35082 . . . Product, feature based modeling, geometric and engineering info
2219/35083 . . . Parametric design, parameters for geometric design and for process planning
2219/35084 . . . Geometric feature extraction, concave and convex regions, object recognition
2219/35085 . . . Incremental feature recognition, extraction, changes are added as new features
2219/35086 . . . Machining feature extraction, geometry and machining parameters
2219/35087 . . . Hole extraction for sheet metal
2219/35088 . . . Using graph grammars to describe parts
2219/35089 . . . Feature definition language
2219/35091 . . . Feature conversion, from design to process features or else
2219/35092 . . . MBM modular boundary model, FFC face to face composition model
2219/35093 . . . Feature is stad single tool approach direction, or mtad multiple tool approach
2219/35094 . . . Object oriented feature finder
2219/35095 . . . Features library
2219/35096 . . . Kind of feature, rotational parts with machining features and relation
2219/35097 . . . Generation of cutter path, offset curve
2219/35098 . . . Automatic coarse, rough and finish cutting path generation
2219/35099 . . . Generation of cutter path for only a designated part of surface
2219/35101 . . . CC cutter contact path
2219/35102 . . . Isoparametric, contact points at intersection of parameter lines on surface
2219/35103 . . . CL cartesian method, apt style, cutter tangent, parallel to drive planes
2219/35104 . . . Steepest directed tree approach intelligent cutter path planning
2219/35105 . . . Polyhedral machining, cutter moved between centroids of adjacent surface triangles
2219/35106 . . . Contour map, cutter moved along contour lines, terraces of part surface
2219/35107 . . . Generate planar section toolpath
2219/35108 . . . Generate offset tool moving path in restrained curved plane
2219/35109 . . . Clean up region, volume left uncut by too large tool pass after finishing
2219/35111 . . . Automatically search for clean up regions, generate clean up tool pass
2219/35112 . . . Define object with spline, convert to raster, mosaic of points to make object
2219/35113 . . . Generation of compound, composite surface
2219/35114 . . . Generation of connection between two or more surfaces
2219/35115 . . . Project 3-D surface on 2-D plane, define grid in plane
2219/35116 . . . RFS rotation free surfaces, needs c x y z axis, non axis symmetrical surfaces
2219/35117 . . . Define surface by elements, meshes
2219/35118 . . . Generate intersection of offset surfaces
2219/35119 . . . Combine different forms, shapes
2219/35121 . . . Generate connection between two paths
2219/35122 . . . Generate random paths along a raster path
2219/35123 . . . Calculate volume of object
2219/35124 . . . Calculate center of gravity of object
2219/35125 . . . Surface with changing cone angle, different upper and lower surface shape
2219/35126 . . . Bezier or Ferguson surface
2219/35127 . . . Visibility maps, tool sees all points of interest on workpiece
2219/35128 . . . Propeller blade
2219/35129 . . . Generate composite surface by a single polynomial calculation
2219/35130 . . . Generate polynomial surface
2219/35132 . . . Generate path as function of precision and surface finish of each portion
2219/35133 . . . B-spline surface fitting
2219/35134 . . . 3-D cad-cam
2219/35135 . . . Predict surface machining precision
2219/35136 . . . Determine offset using closed ball expansion, 2-D square, 3-D cubic approximation
2219/35137 . . . Create part generic, derive from known part or combination of parts
2219/35138 . . . Superpose part of 3-D model on a straight, curved wall
2219/35139 . . . Define surface by cyclides, circular sections with variable radius
2219/35141 . . . Specify side of zone, line, circle for allowed region
2219/35142 . . . Generate tile patterns, mosaic
2219/35143 . . . Reconstruct free form surfaces
2219/35144 . . . Egosphere: spherical shell 2-5-D around robot, objects are projected on it
2219/35145 . . . Voxel map, 3-D grid map
2219/35146 . . . Enter data, calculate 3-D curve or surface, sculptured surface, okisurf
2219/35147 . . . Generation of nice looking composite surface
2219/35148 . . . Geometric modeling for swept volume of moving solids
2219/35149 . . . Generate model with haptic interface, virtual sculpting
2219/35151 . . . Modeling geometric, generation or forming of curved surface
2219/35152 . . . Part coding, description from 3-D cad database
2219/35153 . . . Group and retrieve similar designs from cad data
2219/35154 . . . Convert 2-D workpiece in rectilinear polygon, simplified skeleton
2219/35155 . . . From parts catalog, database, define part relationships, product definitions, specifications
2219/35156 . . . Group technology, identify and group similar parts, tools and machines
2219/35157 . . . Machinability, productibility, reject nc program if tool motion not possible
2219/35158 . . . Calculation of contact point of tool on surface, curve
2219/35159 . . . With nominal blank and model in memory define tool path and machine workpiece
2219/35161 . . . Determine orientation of workpiece
2219/35162 . . . Determine workpiece placement, nesting in blank, optimize, minimize loss material
2219/35163 . . . Generation of inverse offset surface, tool center on surface, tip shows offset
2219/35164 . . . Reverse engineering, camera and probe to inspect workpiece and machine are the same ones
2219/35165 . . . Automatic cutter selection
2219/35166 . . . Virtual boundary method to plan coarse and then fine machining
2219/35167 . . . Automatic toolpath generation and tool selection
2219/35168 . . . Automatic selection of machining conditions, optimum cutting conditions
2219/35169 . . . Automatic generation of set up data as function of form to be machined, kind of operation
2219/35171 . . . Automatic selection of machining conditions as function of controlled machine
2219/35172 . . . Lookup tables for technology, machining parameters
2219/35173 . . . Automatic selection of machine type
2219/35174 . . . Decide if blank has to be measured beforehand
2219/35175 . . . Select machining parameters with fuzzy logic
2219/35176 . . . Constraint, machining constraint, process type like only milling possible
2219/35177 . . . Power constraint for horizontal and vertical cutting forces
2219/35178 . . . Machining parameter constraint, feed, speed, dimension of part
2219/35179 . . . Tolerance constraints as function of process capability and manufacturing costs
2219/35181 . . . Machining condition constraints, coolant, chip removal, previous forming
2219/35182 . . . Scallop hull generation and its offset, interference free offset
2219/35183 . . . Maximizing side step, constant CUSP, scallop height, smaller CL datafile for minimizing machining time
2219/35184 . . . Variable step over, from toolpath to toolpath
2219/35185 . . . Select optimum tool radius
2219/35186 . . . Variable step forward on same toolpath
2219/35187 . . . Surface ridges, cusps, scallops, distance of tool traverses as function of curvature
2219/35188 . . . Project workpiece and sheet on screen, position layout to be cut, store contour
2219/35189 . . . Manufacturing function, derive gripper position on workpiece from cad data
2219/35191 . . . Project workpiece and gripper, control relative movement, store result
2219/35192 . . . From design derive sequence of bending so that bending is possible
2219/35193 . . . Manufacturability
2219/35194 . . . From workpiece data derive tool data
2219/35195 . . . Design mosaic, cut tiles, paint tiles and pack mosaic
2219/35196 . . . From workpiece data derive assembly tool data
2219/35197 . . . Assemblability
2219/35198 . . . Combine component electronic catalog, cdrom with cad data to generate nc program
2219/35199 . . . Processability
2219/35201 . . . Use cad data to test function of designed part, design for test DFT
2219/35202 . . . Macroplanning, setup fixture cafp, library machine tables, sequence
2219/35203 . . . Parametric modelling, variant programming, process planning
2219/35204 . . . Planning, generic process planning
2219/35205 . . . Planning of toolstages, comprising selection tools, position and motion
2219/35206 . . . Microplanning, specific machining operations and parameters
2219/35207 . . . Design agent selects planning agent, which selects fabrication agent
2219/35208 . . . Object oriented planning
Function, machine codes G, M

Several M codes sent to several machines

In corner change cutting command to piercing laser beam and laser shutter control

Mode selection between two machining modes, function of setting of switch, block delete

Data handling for auxiliary functions as language to increase functionality

Select in corner different program according to inserted code

Excess-code

Decimal to binary

Under four is 0xxx, over four is 1xxx

To enable manual operation on detection of inserted code

Inserted code calls parallel execution of another program, synchronize

Select in corner different program according to inner, outer machining

Expansion of control words, code of standard language to increase functionality

Data handling for auxiliary functions as function of setting of switch, block delete

Mode selection between two machining modes, laser beam and laser shutter control

Pallet exchange code to get mating nc program

In corner change cutting command to piercing command, to keep angle point intact

Several M codes sent to several machines simultaneously

Execute program and check block of data, on interrupt display block

Display concentric circles

Checksum CRC

Detection of presence of rom cassette or similar, if coupled to internal memory

Check data, parity, diagnostic

Checking electronics

Watchdog, count or integrate number of data errors before alarm

Sensor to detect functioning of signal conditioning elements

Parity

Excess in error

Two identical tapes

Double reader

Checksum CRC

Ignore invalid program

Detect overlap of program, if new data is entered before old is handled, stop

Verify if loaded program into memory or stored entered before old is handled, stop

Programmed speed automatically limited to min and max transmission range speed

Plausibility check for data, within permissible range

Plausibility check for data, within permissible range

Run tape without machining, tape proving, dry run, test run

Verify, check program by drawing, display part, testpiece

Verification of instructions on tape, direct or by comparing with reference

Display machining state and corresponding control program

Record history, log, journal, audit of machine operation

By making, plotting a drawing

Execute program and check block of data, on interrupt display block

Display concentric circles
Stop test run, correct instruction or block, restart test run
Inhibit operation if part shape not compatible with raw material shape
Convert program to voice output to check program
Print screen display
Verify if generalised data block has all words required
On error, push button to reverse execution mode of block, stop, correct
Set and store command code together with display colour, detected on execution
Dry run, compare simulated output with desired finished profile, alarm, inhibit
Real time analysis, check of program, just before machining
Before machining, verify if all different machining start points are correct
Interference of all tools of turret, or part of tool base with chuck, workpiece
Print out of program on paper, on screen
Update simulator with actual machine, control parameters before start simulation
Actual execution times acquired during machining used in simulation
Remote simulation of machining program
Display working state, process
Display, validate tool path for boundary, surface interference
Display workpiece and machine, chuck, jig, clamp, tool
Projection, two, three section views
Interference checking between tool, machine, part, chuck, machining range
Display tool shape, to select tool for program, or for interference
3-D display of workpiece, workspace, tool track
Show alternatively static and dynamic locus, during static update of dynamic
Display only tool locus, dynamic
Display dynamic tool locus from entered start point to present position
Point to two points on tool locus, calculate and display value
Two, more pictures separated on screen, display
Display of locus with possible correction of machining
Scale image automatically to display whole tool locus or indicated area
Display tool locus together with correlated machining parameter, load motor
Shift view as function of shift of tool with respect to workpiece
Display entire image within an enlarged image
Display only machined part
Use solid and wire frame plotting to display tool locus, workpiece
Display raw material, blank, tool locus, workpiece, alarm if error
Display entire part and zoom of detail
Update display image only if tool advanced over a defined distance
Display locus and corresponding actual block
Program has instruction to display specific information
Display virtual tool, locus, part to check possibility of execution next block
A mark for present position of tool, a mark for end point of block, colour
Display finishing, finishing margin, work, tool and chuck shape, different colours
Set colour change for a block, display locus for that block in different colour
Display path and coating thickness and painting time
Display part, programmed locus and not yet machined, uncompleted portions of part
Display entry of high level program together with corresponding nc program
VMMC: virtual machining measuring cell simulate machining process with modeled errors, error prediction
Different colour, texture as function of distance, direction between tool and workpiece
Display part, programmed locus and tool path, trajec, dynamic locus
While machining probe model, sense drawing by same program, stop if deviation
By making a testpiece
While machining compare real path with simulated, command path, contour display
Polar coordinates, turntable
Generate at jump a fictive instruction equal to sum of previous instructions
Data handling
Setup data, includes scale, range, type, selected together with part program
If a pattern contains another pattern, separate date to avoid overlap
Discriminate between setup data and machining data
Discriminate between data for servocontrol directly and nc processing data
Group similar operations, to select correction, compensation values
Generate data on component arrangement
Merge normal nc program with manual entered monitoring, diagnostic criteria
Configure buffer dynamically, store two 3-D blocks or one 6-D block
Fill buffer dynamically, track read out and write in addresses, fifo
Only read buffer, advance tape while machining with data from read buffer
Read and work buffer, machine while read in, no switching between buffers
Read and work buffer, machine while read in, buffers switched alternative
Data from read instead of work buffer, load data directly to work buffer
Store variable block, word length into memory
Data storage, buffer
Remote instruction to operate machine tool
its interface selected
Manual device is automatically recognised and
Special interface for manual input to pc
on housing
Clamp detachable teaching box magnetically
DPC direct programming at the console
compensate for contour error
Calculate new position data from actual data to
characters along curve
Position data, calculate data to project
pulses
Decompose axis movement, group
function of scale and intermediate data
Prepare seam data for each pattern size as
store as intermediate data
Divide scanned pattern in several closed area,
cutting conditions
Calculate allowable machining capability from
cutting conditions
Calculate midline of tapeline contour, as
reference line for stitching
Divide scanned pattern in several closed area,
store as intermediate data
Prepare seam data for each pattern size as
function of scale and intermediate data
Decompose axis movement, group components, interpolate separately, superpose
pulses
Position data, calculate data to project
characters along curve
Calculate new position data from actual data to
compensate for contour error
DPC direct programming at the console
Clamp detachable teaching box magnetically
on housing
Special interface for manual input to pc
Manual device is automatically recognised and
its interface selected
Remote instruction to operate machine tool
3-D three dimension, space input, spaceball
3-D joystick
Handle, joystick connected to n+1 wires for n
degrees of freedom
Bird, free flying hand controller, receives
signals from transmitters in space
Four and more-DOF hand controller, joystick,
manipulandum
Unit freely movable in space, detect its
position, orientation by triangulation
6-DOF force reflective hand controller frhc
16-DOF glove attached to 6-DOF hand
controller, superposition
18-DOF glove with fifteen load detectors on
each finger, eighty one in total
Prepare, enter next program during execution
of actual program, machining
User controls machine with eye motion,
activates icons on display
Block selection, search
Enter code number directly for function, no use
of function keys
Interactive
Format guide to guide user during input of data
During execution, display asks for parameters,
operator answers, machine again
Enter part geometry and manually control path
free, directly, real time, cutting
Display, if needed, tolerance memo data at
place where real data must be input
Means, manual input, input reference, hand
wheel
Decimal
Joystick
Keys or buttons
Production design metaphore, tool, operation
like input system
Hand wheel turns resolver to control movement
slide
Portable drill, screw driver to set position of
axis instead of handwheel
Gesture interface, controlled machine observes
operator, executes commands
Joystick for coarse and handwheel for fine
movement
Earprotection, earphone
Potentiometer
Datasuit, arm sleeve, actor, operator wears
datasuit and generates motion
Joystick and buttons for menu and function
selection, scrolling, +sign and -sign
Mouse with additional wheel, switches for
position control
Two axis foot pedal
Voice announcement, oral, speech input
Switch between joystick and pedal control
Foot pedal
Disk segments connected to different inputs of
microprocessor, represent different positions
Joystick for coarse, rotary encoder for fine
movement
2219/35458 . . . Control command embedded in video, audio stream, signal
2219/35459 . . . Knob, handle, handwheel delivers pulses, electronic handwheel, digitpot
2219/35461 . . . Digitizing, menu tablet, pencil
2219/35462 . . . Mouse
2219/35463 . . . Trackball
2219/35464 . . . Glove, movement of fingers
2219/35465 . . . Hand wheel
2219/35466 . . . Select with mouse button coarse or fine movement control
2219/35467 . . . Select between control modes, jog, freeform, grid, corner, locate, contour, slot
2219/35468 . . . Select between teaching, regulate position and direct control of position
2219/35469 . . . Select with button specified picture, interrupt addresses selection table
2219/35471 . . . Select between run and step command mode, step forward, reverse
2219/35472 . . . Mode selection
2219/35473 . . . Input limit values of speed, position, acceleration or force
2219/35474 . . . Enter fuzzy command, instruction, like move closer
2219/35475 . . . Set tolerance values
2219/35476 . . . Switch from auto to manual if operator moves feedback detector, to set parameter
2219/35477 . . . Accelerate input data, exponent as function of pressure, time, turning speed
2219/35478 . . . Set flexibility of axis in working coordinates, to move real axis manually easily
2219/35479 . . . Set values, speed of machine as function of force, pressure, duration on key
2219/35481 . . . Display, panel
2219/35482 . . . Eyephone, head-mounted 2-D or 3-D display, also voice and other control
2219/35483 . . . Synoptic display for work shape during machining
2219/35484 . . . Use two image memories, update second memory while display first memory
2219/35485 . . . Library of images, pictures, select and modify each, compose them
2219/35486 . . . Use of two cursors on screen
2219/35487 . . . Display and voice output incorporated in safety helmet of operator
2219/35488 . . . Graphical user interface, labview
2219/35489 . . . Discriminate, different colour, highlight between two states
2219/35491 . . . Workpiece date display, position, height
2219/35492 . . . Display needed workpiece, tool or data to continue execution of program
2219/35493 . . . Display workpiece and tool data together
2219/35494 . . . Online documentation, manual, procedures, operator, user guidance, assistance
2219/35495 . . . Messages to operator in multimedia, voice and image and text
2219/35496 . . . Display cursor in changing colour to indicate that object can be selected
2219/35497 . . . Use colour tone, hue to indicate amount of processed quantity
2219/35498 . . . Synoptic display of available, selectable control modules with their functions
2219/35499 . . . Model of process, machine and parameters

G05B

2219/35500 . . . Colour display
2219/35501 . . . Display picture, image of place of error
2219/35502 . . . Eye tracking associated with head mounted display to detect eye position
2219/35503 . . . Multilingual communication, messages in different languages
2219/35504 . . . Display two windows, one with nc-data, other with general application data
2219/35505 . . . Camera images overlayed with graphics, model
2219/35506 . . . Spider, radar, parallel axes, multivariate plot
2219/35507 . . . Operator chooses among different GUI formats
2219/35508 . . . Double large character on screen
2219/35509 . . . Cursor on screen
2219/35510 . . . Display entered, measured values with bargraph
2219/35511 . . . Setting tool condition, tool set in tool exchanger, present or not
2219/35512 . . . Workpiece set condition, workpiece present or not
2219/35513 . . . Three linear movements in a single plane for three actuators
2219/35514 . . . Use same data, program for workpieces with different length, but same profile
2219/35515 . . . Superposition data, three memories for 2-D projection and z profile and surface structure
2219/35516 . . . Machining data and tool data
2219/35517 . . . Machining and parts on workpiece arrangement data, machine each, then cut out
2219/35518 . . . Database for standard machining data and for personal machining data
2219/35519 . . . Data one bit better than measurement, rest accumulated in memory
2219/35520 . . . Approach data and machining data
2219/35521 . . . Use same data for different operations, coarse and fine, cutting and grinding
2219/35522 . . . Number of workpieces to be machined, cut
2219/35523 . . . Range of number of workpieces to be machined, cut
2219/35524 . . . Create machining conditions database by analyzing actual machining nc program
2219/35525 . . . Monitoring current machining, store information in database as a new working case
2219/35526 . . . Operator inputs manually evaluation of current machining
2219/35527 . . . Comment, work directive, message to operator and control signals together
2219/35528 . . . Use, input 2-D data, sectional profile to machine 3-D surface
2219/35529 . . . Conversion input data
2219/35530 . . . Decimal to binary
2219/35531 . . . Digital to analog
2219/35532 . . . Bed to phase
2219/35533 . . . Bed to decimal
2219/35534 . . . Gray to frequency
2219/35535 . . . Bed to 5-2-1-1-code
2219/35536 . . . Bed to binary
2219/35537 . . . Cartesian to polar and vice versa
2219/35538 . . . Convert male to female form, die to stamp form
2219/35539 . . . Serial to parallel conversion
2219/35540 . . . Convert input data to execution data
2219/35541 . . . 1-to-8-bit conversion
2219/35542 . . . 1-to-16-bit conversion
Nc in input of data, input key till input tape panel
Program mask depends on physical position of panel

Motion command profile
Position, time and slope, tangent of curve
Store curves with packed code, indicating bezier curve parameters
Pack, compress data efficiently in memory

Header with information for display position
Header has code to select proper load program
Data contains header and type of data
data, select region

Delta x, delta v and delta t
Movement, to origin by large movement
Data divided in blocks to be covered by small movement, to origin by large movement
Gerber, hp format to drive plotter or similar xy device

Store motion parameters as function of encoder position
Position data for module and position data within module
Control format in browser, use of xtml and xslt
Position data for module and position data

Table with constant speed and corresponding distance for each segment
Data contains header and type of data
Header has code to select proper load program
Header with information for display position
Part program contains movement and condition statements

Single block format indicates change of speed at start and end
Array structure corresponding to display format
Use of conversion tables
High speed data processor between host and nc for direct conversion of data
Communications adapter converts program to machine or controls directly machine
Use of only delta x values, no absolute values
Each block contains connection, index to other blocks, to form patterns

Display areas, fields on screen correspond to position of keys on panel, matrix
Unified language for machines and translation to each
Attribute programming
State language
Combine general high level language and specialised plc language
Decompiler, translate machine code to hll, reverse processing, easy modification
C++
Basic
Programming in assembler, machine or high level language
Script, interpreted language
High level graphics language, gks
APT
Special language, task programming, oop object oriented programming
Motion, graphical motion control language gmc1
Application programming interface associates component code with driver function
Ladder program for plc, using functions and motion data
Learning task dynamics, process
Edit program step by step
Point to defect, faulty instruction or locus, call up corresponding command block
Correction or modification of program
Program modified after breakage, crash, jamming
Skip of program blocks, jump over certain blocks
Adapt, modify program as function of configuration of machine
G05B

2219/36047 . . . Edit program, change or not header, starting code, output new program with header
2219/36048 . . . Verify, probe workpiece, if position deviation edit, modify program
2219/36049 . . . Relational geometry, change one element, rest of part is adjusted according
2219/36051 . . . Store history of modified file, back-up, update, using different file extensions
2219/36052 . . . Tape tuning with expert system, correction of tape as function of measured parameters
2219/36053 . . . Adapt, modify program in real time as function of workpiece configuration
2219/36054 . . . Modify offset for whole sections collectively, different offsets for sections
2219/36055 . . . Separate, temporary memory or special storage region for corrections only
2219/36056 . . . Modify program, machining order in real time, during operation, dynamically
2219/36057 . . . Select center of pattern for placement of new scaled pattern
2219/36058 . . . Modify workpiece part program without changing approach program
2219/36059 . . . Modify approach program as function of changed part program
2219/36061 . . . Storage, memory area to store history data for previous corrections, editable
2219/36062 . . . Verify if editing, modifying program is suitable for connected controller
2219/36063 . . . During machining, compare simulated with detected profile, correct, modify program
2219/36064 . . . Modify data by using the four rules of arithmetic such as +sign, -sign, xsign, :sign
2219/36065 . . . Modify data by entering a compensation rate value
2219/36066 . . . Collectively modify data instead of each in particular
2219/36067 . . . Altering working order of program blocks
2219/36068 . . . Change program at allowed point of time or program step
2219/36069 . . . Display, on machining error, display error message and correct program
2219/36071 . . . Simulate on screen, if operation value out of limits, edit program
2219/36072 . . . Select pattern, input modification of tolerance
2219/36073 . . . Display original and modified part in different colour, highlight, shading, filling
2219/36074 . . . Display part, select, mark element and edit corresponding block
2219/36075 . . . Set certain command codes, discriminate codes and display in different colour
2219/36076 . . . Select icon and display corresponding instructions
2219/36077 . . . Display and select, modify shape, pattern on screen
2219/36078 . . . Insert, read in new command instruction to modify fixed program
2219/36079 . . . Replace faulty instructions and execute only that portion of the program
2219/36081 . . . Merge, mix original program with taught program
2219/36082 . . . Delete a block by overwriting block with delete control character
2219/36083 . . . Insert a block by using insert control character pointing to address in memory
2219/36084 . . . Amend, modify program by inserting wait and wait dismiss command
2219/36085 . . . Replace faulty instructions from rom, tape by instructions from ram, error setting
2219/36086 . . . Select, modify machining, cutting conditions
2219/36087 . . . Edit, modify program for position errors, moving path, use conversion matrix
2219/36088 . . . Machining parameters, override
2219/36089 . . . Machining parameters, modification during operation
2219/36091 . . . Modification, override as function of conditions, distance
2219/36092 . . . Override limit contour
2219/36093 . . . Lookup table with override for each pattern, tool path
2219/36094 . . . Inhibit or permit override by separate manual switch
2219/36095 . . . Inhibit or permit override by program instruction
2219/36096 . . . Override program by selecting another font, size for letters
2219/36097 . . . Override program to scale workpiece
2219/36098 . . . Overide program to execute a certain number of same blocks, repeat pattern
2219/36099 . . . Stop machine and correct position manually
2219/36101 . . . During machining keep override log, history, journal, kind of record playback
2219/36102 . . . Display override log and nc instructions, select nc block to modify perennial
2219/36103 . . . Adapt, update machining parameters automatically as function of state of processing
2219/36104 . . . IC card
2219/36105 . . . Cd rom
2219/36106 . . . Cassette
2219/36107 . . . Bubble memory
2219/36108 . . . Eprom, earom, eerom
2219/36109 . . . Flash memory
2219/36111 . . . Local memory instead of tape, or combined
2219/36112 . . . Floppy disk, diskette
2219/36113 . . . Rom
2219/36114 . . . Eprom, prom
2219/36115 . . . Card
2219/36116 . . . Harddisk
2219/36117 . . . Magnetic tape cassette
2219/36118 . . . Adapt interactive dialog, help to experience, short cut menu
2219/36119 . . . Mouse with buttons to assist operator with selection of menu instead of pointing
2219/36121 . . . Tree oriented menu, go to root, scroll up down, select mode
2219/36122 . . . Operator menu with submenu for each item
2219/36123 . . . Store statistical history of selected menus, recall for quick data entry
2219/36124 . . . Screen with certain display menu called by pointer, number
2219/36125 . . . Select out of library, beforehand only functions needed for part program
2219/36126 . . . Programmable, configurable function keys, execute a programmed sequence
2219/36127 . . . Menu, help menu for operator, messages
2219/36128 . . . Function menu, switches, keys replaced by menu
2219/36129 . . . Menu keys, function of keys soft defined
2219/36131 . . . Cyclic selection of functions or values by pushing a single key
2219/36132 . . . Selection of menu with lightpen on screen, display
2219/36133 . . . MMI, HMI: man machine interface, communication
2219/36134 . . . Osf-motif standard
2219/36135 . . . Link between sequence, motion or process and diagnostic control
2219/36136 . . . User configurable graphics selected as function of kind of machining, display builder
2219/36137 . . . Configuration of display device, operator panel
2219/36138 . . . Configuration of operator panel, using os-2 modular programs, masks
2219/36139 . . . Edit templates for screen display, and use of keyboard
2219/36141 . . . Configuration with visual basic extension
2219/36142 . . . Using window display, selection of function calls in a window
2219/36143 . . . Use of icon to represent a function, part of program
2219/36144 . . . Display of not allowed function in a different way, light
2219/36145 . . . In case of alarm a window is maximised automatically
2219/36146 . . . Group windows into coherent sets to facilitate a task
2219/36147 . . . Limit number of windows displayed simultaneously
2219/36148 . . . Main process, alarm window takes priority, always on top, safe view
2219/36149 . . . Window, X window
2219/36151 . . . Display is a TV
2219/36152 . . . Panel
2219/36153 . . . Two, several consoles, displays, panels, two different input, joystick
2219/36154 . . . Two displays, for part shape and for corresponding instructions, block
2219/36155 . . . Plc switches functions of panel when changing kind of machining
2219/36156 . . . Keyboard as a drawer
2219/36157 . . . Pendant control box for handwheel control, mounted on controlled axis
2219/36158 . . . Panel for disabled, scanned sequentially
2219/36159 . . . Detachable or portable programming unit, display, pc, pda
2219/36161 . . . Common program panel for nc, pc, switch display diagnostic or part
2219/36162 . . . Pendant control box
2219/36163 . . . Local as well as remote control panel
2219/36164 . . . Common CRT for two input devices
2219/36165 . . . Common program panel for host and cnc, at cnc place, for data from host, cnc
2219/36166 . . . Several panels can be selected by rotation, limited space needed
2219/36167 . . . Use camera of handheld device, pda, pendant, head mounted display
2219/36168 . . . Touchscreen
2219/36169 . . . Remote, host controlled, operated manual data input, keyboard
2219/36171 . . . Edit velocity, motion profile, graphic plot of speed as function of time, position
2219/36172 . . . Select block, item, highlight, colour this block with respect to rest
2219/36173 . . . Combine record play back, hand wheel with normal cnc programming, software
2219/36174 . . . Program divided into modules
2219/36175 . . . Capture image of part, create automatically geometry, sequence of machining
2219/36176 . . . Select servo control parameters
2219/36177 . . . Derive finishing allowance, tolerance from shape and work information
2219/36179 . . . Combine nc programming with cad and order system
2219/36181 . . . Input part data, dimensions, without graphical representation of part
2219/36182 . . . First block contour then parameter input
2219/36183 . . . Offline teaching is sound assisted
2219/36184 . . . Record actions of human expert, teach by showing
2219/36185 . . . Application, for cylindrical groove shape
2219/36186 . . . Programming languages for lathe, mill or general use mixed
2219/36187 . . . End shape data input for end surface configuration
2219/36188 . . . Deep drilling cycle
2219/36189 . . . Wheel dressing program
2219/36191 . . . Prepare rough, coarse machining program
2219/36192 . . . End facing
2219/36193 . . . Semi finish and finish machining
2219/36194 . . . Taper angle machining
2219/36195 . . . Assembly, mount of electronic parts onto board
2219/36196 . . . Grinding cycle
2219/36197 . . . Non circular workpiece, radius and angle input
2219/36198 . . . Gear, thread cutting
2219/36199 . . . Laser cutting
2219/36201 . . . Hole machining
2219/36202 . . . Freeform surfaces
2219/36203 . . . Bending of workpiece, also for long slender workpiece
2219/36204 . . . Lathe, turning
2219/36205 . . . For aspheric non symmetrical mirrors
2219/36206 . . . Embroidery
2219/36207 . . . Involute curve, compressor
2219/36208 . . . Roll grinding
2219/36209 . . . Specify hole shape pattern for boring and store in hole file
2219/36211 . . . Using different cutter sizes, largest as possible for minimizing machining time
2219/36212 . . . Using generic virtual pocket, having virtual boundary, arbitrarily shaped
2219/36213 . . . Grouping of decomposed volumes with similar features
2219/36214 . . . Pocket machining, area clearance, contained cutting, axis milling
2219/36215 . . . Insert automatically program sequence, for corner execution, avoid machining error
2219/36216 . . . Replace entered position data with previous if difference less than tolerance
2219/36217 . . . Commands trigger programming functions
2219/36218 . . . Reuse stored data as programming data after confirmation
Calculate machining information, like time, surface to be machined from program

Entry of chamfer, beveling, rounding of corner shape

Indicate entered element on top, next element below, after input, update top

Enter machining conditions, determine automatically machining data

Enter machining and positioning elements, derive order of execution in real time

Select and insert program from library, select case, variant

Global selection of grid or circle of points by number, distance, angle

Assist operator to calculate unknown points, contours

Combine two programs to obtain new shifted positions and new processing data

Generate missed line when last end point is different from next start point

Translate, convert machine independent to machine dependent program

Before machining, convert, adapt program to specific possibilities of machine

Convert program so that it can be executed in reverse order

Convert program for a 2-axis machine into program for 4-axis machine

Convert grinding machine oriented language to nc machine oriented

Convert character, ascii, text code to internal code and vice versa

Prepare nc program for selected, distinct nc machines

Derive marking from punching program, secondary from principal program

Determine automatic, manual machining of workpiece as function of specific possibilities of machine tool

Convert, translate milling to laser machining program

Convert program for different machines with different M-code, G-code, header

Convert source, high level code to machine, object code

Means, use of tables, correlating functions to instructions

Use of tables to store order of execution of functions

Comments, messages displayed with program instructions, explain process

Remarks, comments as hierarchical structure, indented, corresponds to instructions

Generate automatically machining, stitching points from scanned contour

Generate automatically a balance program for workpiece, dynamic balance

Superpose scanned or finished object image on workpiece model for best fitting

Generate machining program based on a simulation to optimize a machine parameter

Generate machining program from previous test run

Generate machining program from history of similar tools

Machining condition, parameter is workpiece conicity, inclination between surfaces

Define upper lower limit of reciprocating machining, chopping

Indicate region and kind of machining on shape of part

Machining planning, indicate kind of operation

Indicate primary and secondary operations on shape, deliver nc data for each

Program with subroutines for machining process

Input workpiece mounting position, setup

Select cutting direction

Program movement from first to second machining area

Set machining start point from tool, machining data avoiding interference

Tool path editor, for offset, multi-passes

Process planning editor

From blank and finished entered shape, derive machining features

Separate machining data as function of dependence or independance of material

Enter, edit workpiece data

Enter start position, program number for each workpiece

Use general and tool data to select available tool and machining operation

Automatic calculation cutting conditions, but operator can enter them also

Select automatically transmission ratio as function of programmed speed

Program virtual, logical tools, select tool from tables

Flexible fixturing, clamp workpiece, mark clamp regions and store them

Topological classification of forming, machining process

Machining parameter is strategy for making corners

Machining parameter is technology: surface roughness, corner, contour tolerance

Divide complex sculptured surface into smaller, easier to machine areas

Select, enter machining, cutting conditions, material file, tool file

Use of database for machining parameters, material, cutting method, tools

Display symbol pattern for kind of machining performed

Show shape of workpiece, point to coordinates to enter machining parameters

Selection of speed as function of tool diameter

Select machining method, parameters as function of dimensions of workpiece

Cutting, machining conditions by optimisation of time, cost, accuracy

Cutting, machining conditions by empirical equation, like tool life

Method to drill, machine based on ratio bore depth, diameter, select tools
Set feed and speed for specified tool, workpiece as function of ratio cutting force, speed
Stored coefficients, standard cutting conditions, calculate for entered material
Select optimum process for manufacturing articles with longer life
Order, select, determine, change machining sequence, order
Machining plan, indicate order of machining as function of presence of operator
Enter, change order of different programs to be executed
Generate sequences of operations starting from finished product, end with raw
Optimisation of sequence of operations
Determine several machining processes and order as function of available tools
Determine several machining processes and order as function of number of mountable tools
Divide into several machining processes, divide each also in several sub processes
Table, correlation tool type and machining category, process
Table correlation different turrets, slides and possible simultaneous operations
Table with workpiece features and corresponding machining parameters, methods
Table for cutting conditions
Program has different modules, each with own load program
Machining mode selection, pocket, grooving, raster, area, profile
Enter shape with cursor, joystick directions up, down, left, right, slash
If elements cannot be combined, show error
Superpose and combine shapes
Library for shapes of tool holders, fixtures, chucks
Define profile from elements, show only selectable elements
Input symbol for element, search in library and display
Enter start, begin and stop, end point
Simplify display, calculation of shapes by deleting holes, grooves
Program only shape, add approach path and machining conditions automatically
Program shape interactively and tool change position manually by teaching
Shape is alphabetical character
Scan drawing, sketch of part, enter on screen coordinates, lines, circles
Enter shape with mouse, tablet, enter on screen coordinates, lines, circles
Define blank, part, area
Define shape of part
Display closed shape
Display path on cylinder by developing cylinder into a plane
Display block with cursor or highlight actual contour element
Display different faces of work in different colour
Selection from standard forms, shapes, part programs, enter value for variable
Select a shape, select a point or line and enter data
Select and show already defined lines, circles to define from them new element
Select a shape and use it to create a similar shape
Select similar shape and derive motion defining sentences from original shape
Create program for parallel, simultaneous operated slides, timing
Time necessary for one slide equals time for second slide
Prepare program to control multiple slides at the same time
Tool path processing, sequence to cut paths
Select machining method as function of selected tool
Display different tools in different colours
Prepare program for minimal idle strokes with multitool turret
Display feed quantity and cutting speed as function of material to help user
Select tool if tool life duration is sufficient for operation
Enter, edit tool, cutter data
Compensation part program with form of tool, in memory
Display tool shapes to select tool and enter tool dimensions
Select tool as function of part shape, number of grooves and groove width
Display different offset surfaces in different colours to select right tool
Select from table with machining type and corresponding tools
Select tool with fuzzy logic
Select tool as function of collision avoidance
Tool line up, select right order of tool, optimal tool order loading, tool file
Use of cd rom with catalog of tools
As function of tool location
Tool change time, program for optimal tool change time
Tool change time as function of location in tool magazine, index
Tool change time as function of cutter trajectory, spindle and slide times
Tool change time as function of tool switch time, to replace tool with another
Program so that minimal tool changes are needed
Data, read in, distribution
A tape reader for each axis
Tape reader
Measuring object, spectacle glass, to derive position data
Barcode reader
Light, magnetic pen
Common tape reader for two controllers
Dual, multiple tape reader
2219/36375 . . . Combination of two devices, floppy disk and tape reader
2219/36376 . . . Read out of memory synchronized with machine driven axis
2219/36377 . . . Read of several jobs
2219/36378 . . . Either from tape or other source, using same electronics
2219/36379 . . . Read in
2219/36381 . . . Timing, synchronization, start of reader
2219/36382 . . . Speed of read in of data as function of available power for driving servo, safety
2219/36383 . . . Manual input combined with input from computer or tape
2219/36384 . . . Load machining program and workpiece delivery program together
2219/36385 . . . Transfer, load data from rom, bubble memory into ram
2219/36386 . . . Bootstrap loader
2219/36387 . . . Interface between reader and nc
2219/36388 . . . Simulate reader to input data direct to nc, behind tape reader BTR
2219/36389 . . . Switch between input from internal manual thumbwheel and external input
2219/36391 . . . Keep subsystem stopped while load of program
2219/36392 . . . Rewrite date if power loss, check flag area, marked at start, end of writing
2219/36393 . . . Variable read in speed, from max to zero, controls execution speed of program
2219/36394 . . . Read in data from connected pc instead of nc control panel
2219/36395 . . . Load local computer program from host, data transfer ram to rom, BTR
2219/36396 . . . Load also function code needed to execute part program, compact controller
2219/36397 . . . Read reference data only after certain delay, to be sure data will not change
2219/36398 . . . Read of handwritten text
2219/36399 . . . On excess error or on release joystick stop movement, dead man, shut off motors
2219/36401 . . . Record play back, teach position and record it then play back
2219/36402 . . . Use rope, wire, cable, chain to record position and for playback
2219/36403 . . . Incremental detector of position deviation attached to tool for correction
2219/36404 . . . Adapt taught position as function of deviation 3-D, 2-D position workpiece
2219/36405 . . . Adjust path by detecting path, line with a photosensor
2219/36406 . . . Use a spring or gas pressure to keep tool on desired path
2219/36407 . . . Follow path with probe, store deviations for correction during normal operation
2219/36408 . . . During machining, store begin and end of region not finished during first pass
2219/36409 . . . Geometric adaptation by sensing force on surface of workpiece, object
2219/36411 . . . By coarse model of robot to modify commands, learned by feedforward controller
2219/36412 . . . Fine, autonomous movement of end effector by using camera
2219/36413 . . . Adapt playback as function of hardness material, time comparison to reach start point
2219/36414 . . . Compare image detected path with stored reference, difference corrects position
2219/36415 . . . Adjust path and attitude tool by detecting path, line with a photosensor, laser
2219/36416 . . . Adapt taught position as function of deviation 3-D, 2-D position of end effector, tool
2219/36417 . . . Programmed coarse position, fine position by alignment, follow line, path adaptive
2219/36418 . . . Modify trajectory by operator gesture, gesture force sensed by end effector
2219/36419 . . . Compare modified, corrected path with stored reference, difference too large alarm
2219/36421 . . . Assist in correction of position to form a circle or line
2219/36422 . . . During teaching shut off, disable motor to move arm easy
2219/36423 . . . During teaching release brake or decouple clutch from motor
2219/36424 . . . Balance mechanically arm to be moved
2219/36425 . . . Move manually, touch surface, record position
2219/36426 . . . Pilot lamp on end effector to guide operator
2219/36427 . . . Jog feed to a command position, if close enough robot takes over positioning
2219/36428 . . . During teaching set torque instruction for motor to zero
2219/36429 . . . Power assisted positioning
2219/36431 . . . Tv camera in place of tool, on display operator marks points, crosshair
2219/36432 . . . By putting some constraints on some DOF, move within limited volumes, areas, planes, limits motion in x, y or z planes, virtual reality constraints
2219/36433 . . . Position assisted teaching
2219/36434 . . . During teaching direct control signal to power servo for quick response
2219/36435 . . . Electromyographical, myoelectric control signal
2219/36436 . . . Arm follows movement of handheld device, camera detects, analyses motion
2219/36437 . . . Follow coarse programmed surface, detect contact feeler or no force, record point
2219/36438 . . . Manually selection of points on surface to select area to scan automatically
2219/36439 . . . Guide arm in path by slaving arm to projected path, beam riding
2219/36441 . . . Follow contour, line with sensor and record points
2219/36442 . . . Automatically teaching, teach by showing
2219/36443 . . . Auto follow coarse contour, operator can correct contour before recording
2219/36444 . . . Contour, teach contour of sawblade
2219/36445 . . . Mode selection between large displacement and precision work
2219/36446 . . . Keep tool stationary, move workpiece
2219/36447 . . . Project light on path to be followed, keep also distance constant
2219/36448 . . . Teaching, consider workpoint on workpiece temporarily as tip of end effector
2219/36449 . . . During teaching use standard subroutines, assemble them to macro sequences
2219/36451 . . . Handheld toollike probe, work instructor, lightweight, connected to recorder
2219/36452 . . . Touch points with handheld probe, camera detects position and orientation probe
contour of workpiece where other workpiece is
position and force
time.

Record motion and emotion, mimics
parameters at each start up
by force detection

Recording mechanical properties, tonal quality
by force detection

Each taught point has a correlated amount of
shift data, independently modified

Memorize open and closed state, motion
parameters at each start up

Memorize workpiece deviations as function of
angle, compensate, extra feed

Record position, motion and sound

Record motion and emotion, mimics

Position and force

Contour of workpiece where other workpiece is
to be installed

Record position and orientation, posture of
probe, tool

Position of stillstand if no reverse and
acceleration only, data compression

Record position and inclination of tool, wrist

Recording position and other parameters,
current, tool diameter, voltage

Memorize open, closed state of hand and
corresponding motion parameters such as open,
close and move, no move

Select program, main and secondary program

Main and secondary program for repeating
same operations

Part program, workpiece, geometry and
environment, machining dependant, combine

For each contour a tape, a program

Ram for variable servo data, rom for fixed
servo routine

Adapt program to real coordinates, software
orientation

Adapt program to real coordinates, shape,
dimension of tool, offset path

Compare stored conditions to actual, adapt
program

Store in Rom and Ram

Select program or execute command, control
instructions as function of axis position

Each pallet, workpiece, tool holder, selects
corresponding tape reader, program

Select as function of shape, dimension of
workpiece

Select by a detector

Select by a selector, dip switch

Select out of a plurality of programs, patterns

Select by force, height or other detection

As function of material or pattern direction,
nerves of wood for optimal cutting

Select acceleration deceleration profile as
function of kind of machine

Selecting nc program points to mated
manipulator, robot program

Selection of calibration program as function of
parameter to be calibrated

After sporadic change of program, return to
program in use before

Select by combination of detected force,
acceleration, speed, work rate

Select program using a management,
workpiece number

Select with code on workpiece, fixture, clamp,
object

Selection of Rom and ram

On bad data block, reverse motion, correct and
execute block

Regenerate, hold reference previous block for
bad actual value, block

Separate input for machine data from operator
and for program from programmer

Interlock, inhibit nc control while tranferring
data from host

Warn, alert, notify operator to confirm a preset
override value, command

Inhibit, ignore or postpone new command if
previous is still in execution
Signals have a position-dependent frequency.

Relative phase of signals is variable.

Absolute x or delta x values.

X, y, z and tool offset values or direction values.

Macro data or coarse dimension on tape.

Coarse and fine dimensions not repeated in next block.

Enter, punch only different, changed data, same not repeated in next block.

Control data is sequence of position, axis to machine.

On tape also commands for equipment attached.

Mix polar data with cartesian data.

Mix polar data with cartesian data.

Position of hole on workpiece.

Position of hole in tape corresponds with.

Two tapes.

One tape, copy feeler controls several machines.

Two tapes.

Compare, check original tape with converted, copy tape.

Copy entered program in memory to tape.

Forward and backward reading of tape, reverse execution program.

Copy one tape to another, transfer program from tape to tape, back-up.

Tape, band.

One tape, copy feeler controls several machines.

Two tapes.

Position of hole in tape corresponds with position of hole on workpiece.

Cartesian and polar data mixed.

Mix polar data with cartesian data.

On tape also commands for equipment attached to machine.

Control data is sequence of position, axis indication, time delay for speed.

Enter, punch only different, changed data, same not repeated in next block.

Coarse and fine dimensions.

Macro data or coarse dimension on tape.

X, y, z and tool offset values or direction values.

Absolute x or delta x values.

On tape reference and command signals.

Relative phase of signals is variable.

Signals have a position dependant frequency.
Sensor in air gap of drive, detect directly speed or position
Position normally, stop, measure position tool with second independent sensor
Remeasure workpiece regularly for deformation
Protection cover over measuring device, probe, feeler opened when measuring
Digitize position with flexible feeler, correction of position as function of flexion
Digitize, electric wires form grid on surface
Photographic, picture on film, photogrammetry
Touch probe, store position of touch point on surface
Ultrasound transmitters on surface, touch probe detects ultrasound, triangulation
Probe detects electromagnetic fields from grid, antenna like digitizing tablet
Use simultaneous several pairs of stereo cameras, synchronized
After digitizing, edit graphically data
Split beam, stripe projection on object, lines detected with cameras
First a rasterscan, then align workpiece as function of height average, scan again
First coarse measurement, around each point a fine measurement of surface
Sense surface, mean value used as reference surface
Optical triangulation
Digitize every grid point of a raster
Project stripes having a regular sine wave
Mark point to be digitized graphically on screen
Several feelers, probes touch model in rasterpoints
Digitize not only position but also colour
Probe connected to three pair of wires of which the length is measured
Use matrix of optical sensors to detect form, edges of object
Regulated scanning, the head deflection is controlled by a regulation circuit
Controlled scanning, the head is moved along a given path
After digitizing, reconstruct surface by interpolating the initial mesh points
Map of stiffness, compliance of object
Image from object together with references on background
Calibrate work surface, reference markings on object, work surface
Setting reference coordinate frame
Calibrate probe, imitated tool, repeated measurements for different orientations
Measurement program is created, executed on object data, no real object, no CMM is present
Surface covered with grid of electric wires, of coloured tape on object
Workpiece surface covered with shielding coating, against disturbing fields
Projection device, monitor, track tool, workpiece form, process on display

Print out of document measured results or record on tape
Display load on tool, motor graphically on screen
Relative movement
Display machining, processing parameters with curves, pictograms
Display probing result on drawing taken from cad data
Display machining parameters
Indicate, point region on path, locus, display path and machining parameters
Switch display from normal mode to inspection mode, to monitor conditions
Display tool parameters
Display in real time of state variables of control system
Display real, measured machining load
Cutting forces
Indicate service condition, status
Speed error
Motion and force
Display position actual and or target
Display speed
Hall sensor
Digital handheld device with data interface
Invar scale, low temperature coefficient
Marker on workpiece to detect reference position
... X y scale plate instead of two ruler scale, two dimensional scale
... One detector for coarse and fine target location, variable resolution
... Vector gauge, telescopic ballbar
... Single detector for whole range, both x and y axis
... Limit, proximity switch
... Absolute encoder
... Soft limit, store limits in counters, use content of counters as limit
... Inductive, differential transformer, pins
... Acupin
... Rasters, grid on xy-plane
... Photoelectric scanned raster, rule and photocell, microscope
... Rule and photocell, microscope
... Several scales with one device
... Psd position sensitive detector, light spot on surface gives x, y position
... Precision screw
... Photogrammetric position detection
... Shape sensor leads tool, in front of tool
... Optical sensor, delivers analog signal as function of displacement
... Inductive, coil moves over conical, tapered core
... Atomic force probe
... Linear transducer
... Signal analyser
... Extensible ball bar with potentiometer, lvdt
... Magnetic sensor
... Photosensor, as contactless analog position sensor, signal as function of position
2219/37126 . . . Wire, tape around cylinder measures displacement, string encoder
2219/37127 . . . Spm scanning probe microscopy, stm scanning tunneling microscopy
2219/37128 . . . Tool itself emits vibrations to be detected to build an image of surface
2219/37129 . . . Mark, engrave workpiece at specific surface point for measurement, calibration
2219/37131 . . . More pattern, diffraction grating, fringe
2219/37132 . . . Polyhedral prism
2219/37133 . . . Linear, rotary variable differential transformer, lvdt, rvd
2219/37134 . . . Gyroscope
2219/37135 . . . Two counters receiving pulses from two encoders, one for speed, one for position
2219/37136 . . . Control resolution of encoder
2219/37137 . . . Encoder combined with barcode label, reader
2219/37138 . . . Encoder and gear and absolute coder, give together absolute position of rotation
2219/37139 . . . Sampling output of encoder at precisely defined intervals
2219/37141 . . . Programmable divider for counter as buffer for microprocessor, read on interrupt
2219/37142 . . . Center position between two pulses, in the middle of a bit
2219/37143 . . . Divide feedback pulses to make feedback independent from resolution encoder
2219/37144 . . . Delay marker to synchronize motions
2219/37145 . . . Multiturn fine counter counts total pulses, index counter counts turns
2219/37146 . . . Second counter reset to zero on marker, to detect counting errors
2219/37147 . . . Sampling rate low during power loss
2219/37148 . . . Switch between rise, fall of pulses of one phase and of both phases, coarse fine
2219/37149 . . . Multiplexer to send encoder and rotor pole position to same output lines
2219/37151 . . . Handling encoder signal, compensation for light variation, stray light
2219/37152 . . . Combination 00-01-10-11, previous, actual pulses, or two series of pulses, and rom
2219/37153 . . . Encoder delivers only one channel of pulses, using only one detector
2219/37154 . . . Encoder and absolute position counter
2219/37155 . . . Encoder and delta position counter
2219/37156 . . . Pulse derived from belt driving drum
2219/37157 . . . Pulses derived from brake disk having north and south poles
2219/37158 . . . Pulse derived from perforated belt along track
2219/37159 . . . Source of pulse, pulse derived from gear, plate teeth
2219/37161 . . . Motor rotor has a normal magnetised ring and a second ring, magnetic decoder
2219/37162 . . . Marker, reflector mounted on chuck, workpiece holder
2219/37163 . . . Marker derived from phase of motor
2219/37164 . . . Pulse derived from encoder built into ball bearing
2219/37165 . . . Derive pulse from commutation position, build into brushless motor
2219/37166 . . . Rotating magnets shunt motor over resistance, cause current variations
2219/37167 . . . Count number of periods of voltage supply
2219/37168 . . . Inductive sensor senses fluctuations, spikes in motor current
2219/37169 . . . Derive incremental pulse from motor current deviation
2219/37170 . . . Commutation brushes, sensors deliver increment
2219/37172 . . . Encoder with hall effect and reed relays, and decoder gives absolute position
2219/37173 . . . Encapsulate electronics of encoder in resin, electronics and encoder integrated
2219/37174 . . . Encoder with infrared
2219/37175 . . . Normal encoder, disk for pulses, incremental
2219/37176 . . . Disk emits phase shifted pulses, special convertor
2219/37177 . . . Linear encoder
2219/37178 . . . Magnetic marks on screw
2219/37179 . . . Coarse encoder combined with fine grid ccd detector
2219/37181 . . . Encoder delivers sinusoidal signals
2219/37182 . . . Slit plate encoder
2219/37183 . . . Marker or index or coded information as well as position pulses
2219/37184 . . . Hall generator cooperates with magnetic ring, gives signal with dc offset
2219/37185 . . . Magnetic ring and sensor
2219/37186 . . . Camera reads large number of marks, derive frequency of dark-light
2219/37187 . . . Disk with magnetic, inductive sensors
2219/37188 . . . Encoder pulses reset high resolution clock, get position from counting clock pulses
2219/37189 . . . Camera with image processing emulates encoder output
2219/37191 . . . General problems for standing waves, torque, surface inspection
2219/37192 . . . Problems
2219/37193 . . . Multicoordinate measuring system, machine, cmm
2219/37194 . . . Probe work, calculate shape independent of position, orientation, best fit
2219/37195 . . . Measuring dimension independent from accuracy of nc, machine tool
2219/37196 . . . Measuring station, flexible, integrated cmm
2219/37197 . . . From measured data derive form, roundness, orientation, parallel, straightness
2219/37198 . . . Machine as measuring station, use tool or probe, in process incycle
2219/37199 . . . Hole location
2219/37201 . . . Measuring several points at the same time
2219/37202 . . . Footprint, probe piece on machine, then on cmm to avoid errors of machine
2219/37203 . . . Compensate probed values as function of reference plane of fixture, clamp
2219/37204 . . . Move synchronously associated sensor elements independently at both sides
2219/37205 . . . Compare measured, vision data with computer model, cad data
2219/37206 . . . Inspection of surface
2219/37207 . . . Verify, probe, workpiece
2219/37208 . . . Vision, visual inspection of workpiece
2219/37209 . . . Estimate life of gear, drive
2219/37211 . . . Measure temperature, compensate cmm program for temperature
2219/37212 . . . Visual inspection of workpiece and tool
2219/37213 . . . Inhibit measuring if one of the joints is near endstop
2219/37214 . . . Detect failed machine component, machine performance degradation
2219/37215 . . . Inspect application of solder paste, glue to workpiece
2219/37216 . . . Inspect component placement
2219/37217 . . . Inspect solder joint, machined part, workpiece, welding result
2219/37218 . . . Compensate for offset due to probe diameter, detect exact contact point
2219/37219 . . . Predict next probed point from previous probed points
2219/37221 . . . Probe fixture to know datum points
2219/37222 . . . Probe workpiece for correct setup
2219/37223 . . . Identify minimum number of appropriate measuring points
2219/37224 . . . Inspect wafer
2219/37225 . . . Tool holder, measure forces in chuck, tool holder
2219/37226 . . . Monitor condition of spindle, tool holder, transmit to nc controller
2219/37227 . . . Probing tool for its geometry
2219/37228 . . . Tool inspection, condition, dull tool
2219/37229 . . . Test quality tool by measuring time needed for machining
2219/37231 . . . Tool used as touch probe, sensor
2219/37232 . . . Wear, breakage detection derived from tailstock, headstock or rest
2219/37233 . . . Breakage, wear of rotating tool with multident saw, mill, drill
2219/37234 . . . Monitor tool before, after and during machining
2219/37235 . . . Detect bad tool by relative movement of tool with respect to tool holder
2219/37236 . . . Tool serves, acts also as measuring device
2219/37237 . . . Tool collision, interference
2219/37238 . . . Missing tool
2219/37239 . . . Plastic deformation of tool
2219/37241 . . . Displacement of tool, miss inserted
2219/37242 . . . Tool signature, compare pattern with detected signal
2219/37243 . . . Tool breakage by comparing tool image, length before and after machining
2219/37244 . . . Detect tool breakage already in tool magazine
2219/37245 . . . Breakage tool, failure
2219/37246 . . . Compare estimated torques of different axis with reference for breakage
2219/37247 . . . By electrical contact, disappears when breakage
2219/37248 . . . By monitoring changes in capacitive circuit
2219/37249 . . . Correction coefficient of life time as function of kind of machining
2219/37251 . . . Selfcorrecting, counter for tool life adapts correction
2219/37252 . . . Life of tool, service life, decay, wear estimation
2219/37253 . . . Fail estimation as function of lapsed time of use
2219/37254 . . . Estimate wear of subsystem of machine with measures from other subsystems
2219/37255 . . . Using fuzzy logic techniques
2219/37256 . . . Wear, tool wear
2219/37257 . . . Crater wear of tool
2219/37258 . . . Calculate wear from workpiece and tool material, machining operations
2219/37259 . . . Resolver for coarse, photo cell for fine position on grid crossing
2219/37260 . . . Encoder and potentiometer to detect fault measurement
2219/37262 . . . Mixing pins and fine positioning
2219/37263 . . . Absolute and incremental encoder, detector combined
2219/37264 . . . Cam for absolute positions, encoder for incremental position
2219/37265 . . . Rotary potentiometer and incremental counter for each maximum
2219/37266 . . . Infrared
2219/37267 . . . Thermocouple
2219/37268 . . . Tool workpiece junction, thermoelectric interface
2219/37269 . . . Ultrasonic, ultrasound, sonar
2219/37271 . . . Using standing waves
2219/37272 . . . Capacitive
2219/37273 . . . Wheatstone bridge
2219/37274 . . . Strain gauge
2219/37275 . . . Laser, interferometer
2219/37276 . . . Position changes frequency
2219/37277 . . . Inductive proximity sensor
2219/37278 . . . Optical waveguide, fiberoptic sensor
2219/37279 . . . Fiber optic proximity sensor
2219/37281 . . . Laser range finder
2219/37282 . . . Current transformer
2219/37283 . . . Photoelectric sensor
2219/37284 . . . Capacitive 3-D proximity sensor
2219/37285 . . . Load, current taken by motor
2219/37286 . . . Photoelectric sensor with reflection, emits and receives modulated light
2219/37287 . . . Fiber optic interferometer
2219/37288 . . . Tracking lasers follow object, reflection gives 3-D position
2219/37289 . . . Inductive
2219/37291 . . . Electro acoustic
2219/37292 . . . Eddy current
2219/37293 . . . Magnetostrictive effect on ferrous rod, ultrasonic wave, time delay measured
2219/37294 . . . Coarse digitized position combined with fine digitized analog position signal
2219/37295 . . . Measure workpiece while machining other workpiece
2219/37296 . . . Electronic graduation, scale expansion, interpolation
2219/37297 . . . Two measurements, on driving motor and on slide or on both sides of motor
2219/37298 . . . Two measurements, position of slide and position of tool
2219/37299 . . . Measure same parameter from three different space directions
2219/37301 . . . Two measurements, speed with tachometer and speed with encoder
2219/37302 . . . Measure tool length, workpiece configuration without stopping movement
2219/37303 . . . Two measurements, speed of motor and speed of load
2219/37304 . . . Combined position measurement, encoder and separate laser, two different sensors
2219/37305 . . . Drive step motor with pulses, at stop with dc
current to avoid emi when measuring
2219/37306 . . . Two sensors and two scales for same
measurement of relative movement between x
2219/37307 . . . Detector in line, in plane of tool to avoid
parallax
2219/37308 . . . Measure workpiece relieved from stress, redrew,
disengaged tool
2219/37309 . . . Selecting a desired sensor structure
2219/37311 . . . Derive speed from current, use of lookup table
2219/37312 . . . Derive speed from motor current
2219/37313 . . . Derive speed from position
2219/37314 . . . Derive position from speed
2219/37315 . . . High speed and low speed signals are derived
in a different way
2219/37316 . . . Derive speed from two phased position signals,
with high range and resolution
2219/37317 . . . Derive position from current, voltage, back
electromotive force bemf
2219/37318 . . . Derive speed from back electromotive force, bemf
2219/37319 . . . Derive acceleration, force, torque from current
2219/37321 . . . Derive acceleration from net driving force
2219/37322 . . . Derive position from frequency power supply
2219/37323 . . . Derive acceleration from position or speed
2219/37324 . . . Derive position, speed from acceleration
2219/37325 . . . Multisensor integration, fusion, redundant
2219/37326 . . . Automatic configuration of multisensor,
adaptive, active sensing
2219/37327 . . . Select lookup table corresponding to sensor
2219/37328 . . . Decentralised data fusion
2219/37329 . . . Far away and near by sensor groups
2219/37331 . . . Sensor fusion using extended kalman filter
2219/37332 . . . Detect power of noise source using sound and
visual sensors
2219/37333 . . . Position of control valve and position of
controlled actuator
2219/37334 . . . Diameter of tool with teeth
2219/37335 . . . Diameter tool
2219/37336 . . . Cutting, machining time
2219/37337 . . . Noise, acoustic emission, sound
2219/37338 . . . Magnetic or electric property of tool to control feed
2219/37339 . . . Eccentricity, cylindricity, circularity
2219/37341 . . . Sectional distortion of machining face of
workpiece
2219/37342 . . . Overload of motor, tool
2219/37343 . . . Load, vectorial components of load
2219/37344 . . . Torque, thrust, twist, machining force measurement
2219/37345 . . . Dimension of workpiece, diameter
2219/37346 . . . Cutting, chip quality
2219/37347 . . . Speed, velocity
2219/37348 . . . Power, wattmeter voltage times current
2219/37349 . . . Unbalance of tool or tool holder
2219/37351 . . . Detect vibration, ultrasound
2219/37352 . . . Frequency
2219/37353 . . . Amplitude
2219/37354 . . . Powerfactor, phase between voltage and current
2219/37355 . . . Cutting, milling, machining force
2219/37356 . . . Torsion, twist
2219/37357 . . . Force, pressure, weight or deflection
2219/37358 . . . Depth of cut
2219/37359 . . . Contour, to sense corners, edges of surface
2219/37361 . . . acoustic feedback, for speed, if speed very low
hearing is better than seeing
2219/37362 . . . Hardness
2219/37363 . . . Texture
2219/37364 . . . Thermal conductivity
2219/37365 . . . Surface shape, gradient
2219/37366 . . . Colour, surface colour
2219/37367 . . . Grinding rate
2219/37368 . . . Displacement perpendicular to probe
movement
2219/37369 . . . Measure tool length and diameter together with
single sensor
2219/37371 . . . Flow
2219/37372 . . . Position and speed
2219/37373 . . . Friction
2219/37374 . . . Deflection
2219/37375 . . . Climate, temperature and humidity
2219/37376 . . . Inclination, gradient of machine base
2219/37377 . . . Roundness of workpiece
2219/37378 . . . Balance of workpiece from vibration sensor
and angle sensor
2219/37379 . . . Profile, diameter along workpiece
2219/37381 . . . Force in steady rest
2219/37382 . . . Voltage over or short circuit between tool and
workpiece
2219/37383 . . . Tool length
2219/37384 . . . Change of actuator current
2219/37385 . . . Peripheral speed
2219/37386 . . . Lateral movement of tool
2219/37387 . . . Nanometer position
2219/37388 . . . Acceleration or deceleration, inertial
measurement
2219/37389 . . . Magnetic flux
2219/37391 . . . Null, initial load, no load torque detection or
other parameter at no load
2219/37392 . . . Motion
2219/37393 . . . acoustic feedback varies as function of
positional error
2219/37394 . . . Measuring diameter of workpieces with
longitudinal grooves
2219/37395 . . . Detection sparks during machining
2219/37396 . . . Tactile feedback, operator feels reaction, force
reflection
2219/37397 . . . Measuring gap between tool and workpiece
2219/37398 . . . Thickness
2219/37399 . . . Pressure
2219/37401 . . . Differential pressure
2219/37402 . . . Flatness, roughness of surface
2219/37403 . . . Bending, springback angle
2219/37404 . . . Orientation of workpiece or tool, surface sensor
2219/37405 . . . Contact detection between workpiece and tool,
probe, feeler
2219/37406 . . . Detect position of detector contact point
relative to reference on tool slide
2219/37407 . . . Detect position of detector contact point
relative to reference on tool
2219/37408 . . . Combination of contact and contactless
detection to avoid tool contact with workpiece
2219/37409 . . . Measure different pressure of fluid flow on
contacting surface
On machine, on workpiece

Program proposes measuring points

Path planning using ann, for measurement task pattern, optimal path, dummy points

Select measuring program together with control parameters

Simulate measuring program, graphical interactive generation of program

Interactive, enter also tolerance

After entering one measuring cycle, display in separate window instruction list

Program proposes measuring points

On machine, on workpiece

Reference on machine, on workpiece and on tool

Reference on workpiece, moving workpiece moves reference point

Two rotary potentiometers, only one used, switch over to other on ambiguity

Resistor, potentiometers

Tapped resistors, not continuous

Potentiometer with dual wiper

Magnetic resistor

Dual potentiometers with sin and cos output

Continuous rotary potentiometer, no end

Magnetic resistor sensors used as incremental encoder

Two, more slides use resolver with common secondary, different primary frequency

Resolver, synchro

Synchro

Resolver

Resolver with several phases

Resolver emits two redundant signals for safety

Single resolver for speed, rotor and absolute position, IMAS

Inductosyn

Excitation as function of speed of rotor, to get always stable detection waves

Sampling rate for output of resolver as function of pulse rate of excitation

Control amplitude of excitation of resolver

Synchronize resolver reference frequency with clock of position control

Differential resolver

Phaseshift to reference counted

Resolver emits pulses at zero crossings, counter

Counter combined with angle to digital convertor

Angle to digital conversion

Emit binary code at quadrant 00+01+10+11, count pulse for 11-to-000 and 00-to-11

Compensate non linearity of transducer by lookup table

Store measured value in memory, to be used afterwards

Use of different frequency band pass filters to separate different signals

Intelligent sensor, data handling incorporated in sensor

Correction of measured value as function of given, reference surface

Root mean square

Summing, integration of signal

Variable amplification, gain for detected signal, select correct level range

Determine cumulative deviation, difference

Delay detected signal avoids transients, start up noise

Input signal converted to logarithmic value

Set integrator of acceleration detector to zero at velocity zero, avoids drift

Differential use of sensors, to double precision
2219/37505 . . . Debounce contact signal from absolute reference position cam
2219/37506 . . . Correction of position error
2219/37507 . . . Spectral density analysis
2219/37508 . . . Cross correlation
2219/37509 . . . Intelligent sensor, incorporation temperature compensation
2219/37511 . . . Select and process only those detected signals needed for a certain purpose
2219/37512 . . . Correction for detection delay
2219/37513 . . . Convert time domain signal to frequency domain signal
2219/37514 . . . Detect normality, novelty in time series for online monitoring
2219/37515 . . . Error separation, eliminate eccentricity
2219/37516 . . . Combine results, opinions of multiple but same sensors, fuzzy logic
2219/37517 . . . Compensation of position for vibration of probe, calibration x-y lookup table
2219/37518 . . . Prediction, estimation of machining parameters from cutting data
2219/37519 . . . From machining parameters classify different fault cases
2219/37521 . . . Ann to map sensor signals to decision signals
2219/37522 . . . Determine validity of measured signals
2219/37523 . . . Reduce noise by combination of digital filter and estimator
2219/37524 . . . Sampling of forces and signal analysis are triggered as function of rotation angle
2219/37525 . . . Mean, average values, statistical derived values
2219/37526 . . . Determine time or position to take a measurement
2219/37527 . . . Frequency filtering and amplitude qualification
2219/37528 . . . Separate force signal into static and dynamic component
2219/37529 . . . Synchronous demodulation
2219/37531 . . . Superpose modulated measuring signal on servo command reference
2219/37532 . . . Synchronized data acquisition
2219/37533 . . . Real time processing of data acquisition, monitoring
2219/37534 . . . Frequency analysis
2219/37535 . . . Signal processing, ratio of signals against fluctuation of signals
2219/37536 . . . Rate of change, derivative
2219/37537 . . . Virtual sensor
2219/37538 . . . Window for signal, to detect signal at peak or zero values
2219/37539 . . . Read values twice, for correctness
2219/37541 . . . Switch off measuring, control system during test of encoder, resolver
2219/37542 . . . Curve fitting measured points, predict, extrapolate dimension in time
2219/37543 . . . Set, compare to maximum, peak, minimum value
2219/37544 . . . Compare detected signal to several references to derive several control actions
2219/37545 . . . References to be compared vary with evolution of measured signals, auto-calibrate
2219/37546 . . . Compare two positions measured with different methods, alarm if difference too high
2219/37547 . . . Ignore position information from detector during invalid intervals
2219/37548 . . . Avoid false motion condition, jitter, compare three recent values with possible values
2219/37549 . . . Limit switch protected against overload
2219/37551 . . . Select for each detector type corresponding signal processor
2219/37552 . . . Detect loss of correct excitation moment of step motor, correct excitation
2219/37553 . . . Two cameras one for coarse scanning, other for fine scanning
2219/37554 . . . Two camera, or tiltable camera to detect different surfaces of the object
2219/37555 . . . Camera detects orientation, position workpiece, points of workpiece
2219/37556 . . . Camera detects fictive contour of workpiece, by reflection
2219/37557 . . . Camera for coarse, acoustic array for fine vision
2219/37558 . . . Optical sensor, scanner
2219/37559 . . . Camera, vision of tool, compute tool center, detect tool wear
2219/37561 . . . Move camera until image corresponds to stored image of same workpiece
2219/37562 . . . Scan mark at certain angle, to avoid glare noise
2219/37563 . . . Ccd, tv camera
2219/37564 . . . Center of camera vision aligned with axis of drill
2219/37565 . . . Camera to detect precisely, crosshair, positions on workpiece by operator
2219/37566 . . . Explore autonomous, explore surface until useful measurement possible
2219/37567 . . . 3-D vision, stereo vision, with two cameras
2219/37568 . . . 3-D spectacles, glasses, left and right synchronised with images on screen
2219/37569 . . . Radiography in x and y, x-ray images
2219/37571 . . . Camera detecting reflected light from laser
2219/37572 . . . Camera, tv, vision
2219/37573 . . . In-cycle, insitu, during machining workpiece is measured continuously
2219/37574 . . . In-process, in cycle, machine part, measure part, machine same part
2219/37575 . . . Pre-process, measure workpiece before machining
2219/37576 . . . Post-process, measure workpiece after machining, use results for new or same
2219/37577 . . . In-process and post-process measurement combined
2219/37578 . . . Compare images of workpiece before and after machining
2219/37579 . . . Run away measured value by differentiating measured signal, rate of change
2219/37581 . . . Measuring errors
2219/37582 . . . Position, angle of workpiece surface
2219/37583 . . . Detect separation, cutting, penetration, piercing, break through material
2219/37584 . . . Deformation of machined material
2219/37585 . . . Start, begin and end, halt, stop of machining
2219/37586 . . . Detect, discriminate cutting or non cutting machining state
2219/37587 . . . Count number of machining cycles, frequency use of tool
2219/37588 . . . Detect swarf, building up of swarf
2219/37589 . . . Measure drift of servo during positioning, not disturbing actual position
Robotics, robotics to robotics hand
Move end effector on ellipse, circle, sphere

Robot, manipulator control

Output modulated signal on detection of
By measuring current, load of motor

Means detecting object in forbidden zone
collision changes if object detected
Use of special detector the output of which
window
By measuring changing forces in a time
Detect collision, blocking, stall by change, lag in position
Detect collision, blocking by use of integrated load between two limits
Detect collision, blocking by measuring change of velocity or torque
By measuring changing forces in a time window

Material removal rate
System time constant
Hysteresis of actuator, servo
Accuracy, repeatability of machine, robot
Thread form, parameters
Circular form
Center and diameter of hole, wafer, object
Over-travel
Relative movement between tool and workpiece carriage
Transfer function, kinematic identification, parameter estimation, response
Cutter axis tilt of end mill
Number of workpieces, counter
Dead time, between detecting finished workpieces and feedback measured value
Use same monitoring tools to monitor tool and workpiece
Tolerance of form, shape or position
Observe, monitor position, posture of tool
Characteristics of machine, deviation of movement, gauge,
Inertia, mass of rotating, moving tool, workpiece, element
Detect collision, blocking, stall by change, lag in position
Detect collision, blocking by use of integrated load between two limits
Detect collision, blocking by measuring change of velocity or torque
By measuring changing forces in a time window
By measuring changing forces in different position zones
Measure elapsed time needed for positioning
Use of special detector the output of which changes if object detected
Detect sudden change of direction due to collision
Means detecting object in forbidden zone
By measuring current, load of motor
Output modulated signal on detection of blocking instead of flat signal
By measuring vibration

G05B

Calibrate only for end position workpiece to define its position in space
Two cameras detect same reference on common reference grid
Screw axis measurement, jacobian estimation from wrist and joint torques, no motion
Screw axis measurement, each joint moved in circle, cpa circle point analysis
Screw axis measurement, jacobian estimation from wrist and joint torques, no motion
Screw axis measurement, jacobian estimation from end effector and joint speeds
Determine position of two cameras by using a common reference grid
Two cameras detect same reference on workpiece to define its position in space
Calibrate only for end position

Cutter axis tilt of end mill

G05B

Calibrate only some links, part of dofs, lock calibration of manipulator while tool is mounted
Calibration of manipulator
Spheric tool interrupts transmitted calibration beam, in different configurations
Calibration of manipulator

Calibrate only some links, part of dofs, lock Calibrate by switching links to mirror position, tip remains on reference point

Feedback for stability of manipulator, felt as force reflection
Move end effector in a plane, describing a raster, meander

Calibrate arm during scanning operation for identification of object

Locate movable manipulator relative to object, compare to stored gridpoints
Match virtual world with real world
With different manipulator configurations, contact known sphere, ballbar
Simultaneous calibration of manipulator and camera

Forward calibration, find actual pose world space for given joint configuration
Inverse calibration, find exact joint angles for given location in world space
Calibration by cmm coordinate measuring machine over a certain volume
With probe, touch reference positions
Transform between measuring and manipulator coordinate system
Shut off, disable motor and rotate arm to reference pin
Calibration of manipulator
Spheric tool interrupts transmitted calibration beam, in different configurations
Calibration of manipulator while tool is mounted
Calibrate only some links, part of dofs, lock some links, ref pins on links
Relative to base calibrated 6-DOF device, cmm connected between wrist and base
Verify if calibration position is a correct, by comparing with range in rom
Use of model for robot and for measuring device
Touch probe senses constraint known plane, derive kinematic calibration
Laser tracking of end effector, measure orientation of rotatable mirror
Use of telescopic ballbar
Screw axis measurement, each joint moved in circle, cpa circle point analysis
Screw axis measurement, cpa circle point analysis
Screw axis measurement, jacobian estimation from wrist and joint torques, no motion
Screw axis measurement, jacobian estimation from end effector and joint speeds
Determine position of two cameras by using a common reference grid
Two cameras detect same reference on workpiece to define its position in space
Calibrate only for end position

Robotics, robotics to robotics hand
Robot, manipulator control
Move tip of arm on straight line
Move end effector on ellipse, circle, sphere

Calibrate arm during scanning operation for identification of object
Locate movable manipulator relative to object, compare to stored gridpoints
Match virtual world with real world
With different manipulator configurations, contact known sphere, ballbar
Simultaneous calibration of manipulator and camera
Forward calibration, find actual pose world space for given joint configuration
Inverse calibration, find exact joint angles for given location in world space
Calibration by cmm coordinate measuring machine over a certain volume
With probe, touch reference positions
Transform between measuring and manipulator coordinate system
Shut off, disable motor and rotate arm to reference pin
Calibration of manipulator
Spheric tool interrupts transmitted calibration beam, in different configurations
Calibration of manipulator while tool is mounted
Calibrate only some links, part of dofs, lock some links, ref pins on links
Relative to base calibrated 6-DOF device, cmm connected between wrist and base
Verify if calibration position is a correct, by comparing with range in rom
Use of model for robot and for measuring device
Touch probe senses constraint known plane, derive kinematic calibration
Laser tracking of end effector, measure orientation of rotatable mirror
Use of telescopic ballbar
Screw axis measurement, each joint moved in circle, cpa circle point analysis
Screw axis measurement, cpa circle point analysis
Screw axis measurement, jacobian estimation from wrist and joint torques, no motion
Screw axis measurement, jacobian estimation from end effector and joint speeds
Determine position of two cameras by using a common reference grid
Two cameras detect same reference on workpiece to define its position in space
Calibrate only for end position
Two manipulators operate on the same object with the same manipulator.

Task distribution between involved manipulators.

Optimal hold and moving force, torque.

Hand-eye cooperation, active camera on first arm follows movement of second arm.

Select grasp pattern based on motion oriented coordinability.

Regrasp object as function of impact motion path, place it.

Conveyor, pick up article, object from press brake.

Manipulator cooperates with moving machine, visualize, pick up.

Use of two dimensional maps and feedback of redundant manipulator.

Reduce impact effect by impact configuration of redundant manipulator.

Artificial field potential algorithm, force repulsion from obstacle.

Inhibit movement in one axis if collision danger.

On collision, lead arm around obstacle manually.

Avoid collision with moving obstacles.

Treat interference in hardware, circuit and also in software.

On collision, ann, bam, learns path on line, used next time for same command.

Interference checking between robot and fixture.

Use neural geometric modeler, overlapping spheres.

Self-collision, internal collision, collision between links of one robot.

Estimate own stop, brake time, then verify if in safe distance.

Estimate stop, brake distance in preded time, then verify if in safe distance.

Interlocks inserted in movement process if necessary to avoid collision.

Cooperation with one or more rotating workpiece holders, manipulators.

Manipulator cooperating with conveyor.

Multicooperating sensing modules.

Manipulator control orders conveyor to stop, to visualize, pick up.

Manipulator cooperates with moving machine, like press brake.

Conveyor, pick up article, object from conveyor, bring to test unit, place it.

Pick up article, object, measure, test it during motion path, place it.

Regrasp object as function of impact.

Dual arm, multiarm manipulation, object handled in cooperation.

Use of flexibility or free joint in manipulator to avoid large forces.

Force, load distribution.

Select grasp pattern based on motion oriented coordinability.

Hand eye cooperation, active camera on first arm follows movement of second arm.

Optimal hold and moving force, torque.

Constraint object handled in cooperation.

Task distribution between involved manipulators.

Cooperation between manipulator and vehicle with manipulator.

Path constraint handling of object.

Two manipulators operate on same object.

Follower, slave mirrors leader, master.
Manipulate, handle flexible object
Grasp common rigid object, no movement end effectors relative to object
Task is grasp object with movable parts, like pliers
Manipulate very large objects, not possible to grasp, open palm and use of links
Roll object on base by link control
Grasp tool with two manipulators, rigidity, and use tool
One manipulator holds one piece, other inserts, screws other piece, dexterity
Each of the manipulators holds one of the pieces to be welded together
Robot welds, operates on moving workpiece, moved by other robot
Convert taught program for fixed workpiece to program for moving workpiece
Teach point, move workpiece, follow point with tip, place tip on next point
For multiple manipulators operating at same time, avoid collision
Teach each manipulator independently or dependently from each other
Manual teaching, set next point when tool touches other tool, workpiece
Calculate path of robots from path of point on gripped object
Produce program of slave from path of master and desired relative position
Slave program has no taught positions, receives position from master, convert from master
Moving time between positions in slave program coordinated online with master
One program in robot controller for both robot and machine, press, mold
Scale moving time of all robots, machines to match slowest, no waiting
Slave path is the same as master path and superposed desired relative movement
Swarm, multiagent, distributed multitask fusion, cooperation multi robots
Group transport, transfer object, ant problem
To push or pull on objects, boxes
To assemble two objects, objects manipulation
Use intention inference, observe behaviour of other robots for their intention
Basic behaviour, avoid, follow, aggregate, disperse, home, wander, grasp, drop
Human supervisory control of swarm
Each robot can pick up an information carrier, read and write it, exchange it
Motion skill, relate sensor data to certain situation and motion
To machine together workpiece, desktop flexible manufacturing
Collectively grasping object to be transported
Configuration description language, to define behaviour of system
Task modelling
Search, grip object and bring to a home area, gather object, object placement
Learn social rules, greedy robots become non-greedy, adapt to other robots
Formation control, robots form a rigid formation, fixed relationship
Embodied evolution, evolutionary robots with basic ann learn by interactions with each other
Evolution, best performing control strategy is transmitted to other robots
Coordinate activity by sending pheromon messages between robots, no central control
Resources scheduling and balancing
Multiple robots searching an object
Redundant communication channels with central control
Vehicle moves towards arm if stretched arm, away from it if folded, singular point
Vehicle, coordination between manipulator arm and its moving vehicle
Dynamic interaction between vehicle and manipulator
Add DOFs of mobility to DOFs of manipulator to add user defined tasks to motion
Cooperation between fixed manipulator and manipulator on vehicle
Compensation deflection arm
Compensation position working point as function of inclination tool, hand
Compensation inertia arms
Of movement after lock stop by small movement against load, stop again
Compensation of coulomb friction in joint
Compensation for base, floor deformation
Compensation for gravity
Forward compensation in robot world space, inverse in joint space
ANN as compensator
Flexible joint
Coriolis and centripetal compensation
Torque compensation
Compensate for dead weight of tool as function of inclination tool
Compensation for errors in mechanical components
Compensate thermal effects, expansion of links
Compensate movement before lock stop, by small movement against load, gravity
Compensation gravity
Control, avoid oscillation, vibration due to low rigidity
Use of passive joint, no actuator but brake, brake on or off
Passive compliance, no input of force reference, mechanical resilience, spring
Manipulator used as workpiece handler and for machining operation
Active vibration absorber
Control of joint stiffness
Invariant inertia, constant inertia matrix independent of joint positions
Fuzzy petrinet controller
Petrinet controller
Markov model
Joint space position control
Manipulator is passive, gives operator only feedback of what is currently done
Robot is active, realizes planned trajectory by itself

Switch over from free space motion to constraint motion

If operator on platform moves in certain direction, arm will follow

Select between autonomous or teleoperation control

Distributed tasks, space motion, contact, kinematic conditioning tasks

Compensate tracking error by using model, polynomial network

Adaptive control with stabilizing compensation

Motion scaling

Keep constant orientation of handled object while moving manipulator

Force tracking

Trajectory tracking

Control angular position of joint by length of linear actuator

Disturbance rejection, suppression

Resonance ratio control, between arm and motor

Jacobian transpose control of force vector in configuration and cartesian space

Rmf resolved motion force control, apply known acceleration to payload mass

Operational space formulation, project model into cartesian coordinates

Configuration control, generate end effector forces to compensate dynamics

Computed torque method and H-compensation

Linear parameterization of robot dynamics

Parameterization of inertia, coriolis and centrifugal matrix

Fuzzy adaptation of sliding mode controller

Adaptive switching of multiple models, same model but different initial estimates, different robot model for different areas

Constraint accelerated feedback, distance dependant sampling rate

Track surface without knowing surface geometry

Hybrid integrator back-stepping control, cascaded motor and manipulator subsystems

Torque disturbance control

Trajectory feedforward and feedback to input ann, output a control function

Control additional actuator in each flexible link

Force and vibration control

Velocity blending, change in a certain time from first to second velocity

Adaptive trajectory tracking

Generic motion control operations, primitive skills each for special task

Computed torque fuzzy controller

Control position and orientation of handled object

Control speed, acceleration as function of load and rate of fatigue

Visual servoing combined with inertial measurements

Computed torque controller combined with ann compensating switch type controller

Autonomous distributed control, joint and link is a subsystem, communication intensive

Autonomous distributed control, task distributed into each subsystem, task space

Virtual arm, has end effector on any joint of real manipulator

Behaviour controller, robot have feelings, learns behaviour

Penalty invariance:distribute disturbance equally over all joints, nodes

Task space controller

Switch from task space to joint space controller when close to singularity

Three objective attitude control

GPS to control robotic arm

Calculate driving torque from dynamic model, computed torque method variant

Position joint to minimize energy in previous joints, equilibrium point, attractor

Normal and overload operation modes, robot speed or torque higher than nominal

Torque control using hardware designed for position control

Cutting force disturbances compensated by accelerating a mass within tool head

Algorithm for control

Uncertainty estimation by the bounds

Layer perceptron, drive torque from state variables

Neural adaptation followed by fuzzy correction

Artificial neural network, ffw-nn, feedforward neural network

Course by expert rule based system to correct fine fuzzy system

Neural oscillator

CMAC cerebellar model articulation controller network

Ann in parallel to known dynamics model to correct for unknown dynamics

FFW and PD and ANN for compensation position error

Segmented tree ANN

Ann with pd in parallel, pd corrects response of ANN

Ann parallel with p controller

Ann for compensation torque

FFW ann for torque command, adapt as function of speed and detected speed

Fw ann to compensate torque or speed

NSC neural servo controller

From database find strategy and select corresponding neural servo controller

Forward inverse, dynamics model, relaxation neural network model firm

Position and speed error to fuzzy input, output corrected by ann as function of position

Track control with ann

Adaptive ann controller

Fuzzy neural for adaptive force control

Neural brain based controller based on simplified model of vertebrate nervous system
Ann parallel to pd, learn inverse dynamics and feedforward of torque signal

Learn inverse dynamics, ffw decomposed ann adapted by pid

Learn position correction values to be added to reference values

Learn inverse and forward model together

First learn inverse model, then fine tune with ffw error learning

Trajectory learning

Learn forward dynamics

Learn feedforward control

Backpropagation end effector location error through the link equations

Feedback error learn inverse dynamics, fce use position reference and error

Feedback error learn inverse dynamics, use actual position and error

Learn, detect kinematic contraints in a plane from displacement and force

Three networks, data to cartesian, cartesian to joint angle, joint angle to control

Multiple ann, trajectory control net and force control net

Position control net, pcn combined with velocity control net, vcn

Inverse dynamic network combined with time scaling network for trajectory plan

Multilayer, MNN, four layer perceptron, sigmoidal neural network

Double neural network for tracking, slave microprocessor for servo control

Ann for joint control, ann for trajectory optimization

Ann for identification, ann for convergence, ann for tracking control

Art ann classifier and input selector, bam ann to retrieve collision free path

Two ann, second ann trained with calibration data to learn error first ann

Adapt weights MNN online, MNN as feedforward, maps inputs to joint torques

Position loop ann and velocity loop ann and force loop ann

Force control, force as reference, active compliance

Force control as function of position of tool

Force and position control

Force and motion control

Force as function of distance from boundary, border of grinding area

External force control, additional loop comparing forces corrects position

Model compensates positions as function of position to compensate force deformations

Fuzzy adaptive force control

Fuzzy pi force control

Adaptive force and position control

Switch between position and force control by fuzzy logic

Adaptive force control

Fuzzy adaptive force and position control, hybrid

Fuzzy reinforcement compliance control

Independent joint control, decentralised

Pd controller combined with disturbance rejection at joint

Pd controller combined with joint energy based controller

Impedance control, also mechanical

Admittance control, admittance is tip speed-force

Sliding mode based impedance control

Adaptive impedance control

Force based impedance control

Cooperative impedance control, between fingers or arms

Active compliance control, control tension of spring with dc motor

Workspace impedance control

Joint space impedance control

Generalized impedance control

RCC remote center compliance device inserted between wrist and gripper

Compensation ann for uncertain trajectory in impedance control

Feedback error learning, ffw ann compensates torque, feedback from pd to ann

Joint space observer

Operation, work space observer

Observer, disturbance observer

Fuzzy logic velocity observer, to estimate velocity in joints

Execute motion of path in minimum of time

Time optimal control along path for singular points, having velocity constraints

Tracking path, priority control for component perpendicular to path

Minimize time-energy cost

Adapth path of gripping point as function of position of cooperating machine

Track circular path on inclined surface

Path, correction of path in function of load

By using a cue, part of a stimulus to prompt an adapted reaction pattern

SMC sensory motor coordination

Using a motion map, association between visual position and joint position

Sensorimotor command layer, between task space and sensor, motor space

Host and robot controller and vision processing

Host and robot controller

Expert rule based system to correct parameters impedance controller

Fuzzy for planning, fuzzy neural for adaptive force control

Ffw and ann combined to compensate torque

MMI to path planner to servo controller

Hierarchical, learning, recognition and skill level and adaptation servo level

Task level supervisor and planner, organizer and execution and path tracking

Control panel separated from power control of articulations

Open architecture such as nasrem, nge, dicam, saridis, chimera, gisc, utap, nomad, robline
Map task, application to behaviour, force tracking, singularity to motion to actuator

Level, organization and coordination or distribution of tasks and execution level

Supervisor communicates with several ion control agents

Control unit near robot, control and teaching panel in safe zone

Hybrid control system with neural brain based controller and classical ctler

Cell configuration, selection and connection of cell combinations

Reflex control, follow movement, track face, work, hand, visual servoing

Visual compliance, xy constraint is 2-D image, z position controlled

Laparoscopic surgery, camera on center of operated part, view around, scale

Visual servoing, track end effector with camera image feedback

Dynamic pyramiding, change vision field to small area if high tracking speed, zoom

Camera detects projected image, compare with reference image, position end effector

Compensate hand position with camera detected deviation, new end effector attitude

Expectation based visual servoing, use of model

Manipulator action on screen depends from displayed position on screen

Map image error directly to robot movement, position with relation to world, base not needed, image based visual servoing

Convert hand to tool coordinates, derive transform matrix

Convert position of old, teach to new, changed, actual tool by transform matrix

Machine tool coordinates to manipulator coordinates

Transfer matrix for moving object and robot to absolute space, motion independent

Method, axial rotation of tool to make tool and base coordinates parallel

Design of manipulator

Develop inverse model of system with ann

Obtain optimal parameters of model of system

Power metrics, energy efficiency

Integrated structure and control design

Design of gripper, hand

Effect of scaling drive arms

Diagnostic of robot, estimation of parameters

Robot self diagnostics

Hyper redundant, infinite number of DOFs

10-DOF

Panel on arm, hand of robot, controlled axis

Panel with special keys for robot programming, like gripper, hand, wrist

Using graphic kinematic perspective entered and represented by keys

Keys represent function of gripper, open, close

Direct robot control, click on mouse on variety of display command buttons

Enter a move file, robot will follow a series of instructions

Each function key of pc corresponds to a motor, jog each motor

Free movable unit has push buttons for other than position, orientation control

Joystick mimics manipulator to provide spatial correspondence

Joystick with additional handle for wrist and gripper control

Direct programming at the console

Joystick, handle, lever controls manipulator directly, manually by operator

Voice command, camera detects object, grasp, move

Set manual a coordinate system by jog feed operation

Portable, adapted to handpalm, with joystick, function keys, display

Display of position, of shape of robot and tool

Select between jog modes, user, robot coordinates, tool, system feed, joint feed

Display of manipulator and workpiece and jog directions

Dead man switch

Same teach pendant connects to many robot controllers over network

Pendant, pda displaying camera images overlaid with graphics, augmented reality

Augmented reality for robot programming

Select with mouse button a coordinate plane for micromanipulation

Select program as function of location of mobile manipulator

Rubber actuator, two muscle drive, one for extension other for traction

Flexible microactuator, fluidic controlled fibre reinforced rubber, three tubes

Direct drive

Tendon drive

Vehicle levitated, arm pushes to position vehicle

Finger actuator, ac motor and harmonic gear and encoder

Rotate arm in one direction, forearm in other direction but double speed

Pneumatic actuator, imitates human muscle

Exercise treatment end effector, dexter cube with various switches for tasks

Estimation of human hand impedance in multit joint arm movements

Two fingers each with 2-DOF

Hand, gripper, end effector of manipulator
G05B

2219/39467 . . . Select hand as function of geometric form of hand
2219/39468 . . . Changeable hand, tool, code carrier, detector
2219/39469 . . . Grip flexible, deformable plate, object and manipulate it
2219/39471 . . . Push workpiece in order to grip it correctly
2219/39472 . . . Braced manipulator, for fine positioning hand is resting on table
2219/39473 . . . Autonomous grasping, find, approach, grasp object, sensory motor coordination
2219/39474 . . . Coordination of reaching and grasping
2219/39475 . . . Grasp slightly, rotate object between two fingers by action of gravity
2219/39476 . . . Finger tracks moving light spot on object
2219/39477 . . . Control force and posture of hand
2219/39478 . . . Grip, release again to put object in correct position in tray, regrip and move
2219/39481 . . . Control distance finger from center, radius
2219/39482 . . . Control position of center of grip
2219/39483 . . . Control angle of rotation
2219/39484 . . . Locate, reach and grasp, visual guided grasping
2219/39485 . . . Lift workpiece with two fingers, then grasp it with two additional fingers
2219/39486 . . . Fingered hand, multifingered hand
2219/39487 . . . Parallel jaws, two fingered hand
2219/39488 . . . Each finger gets 1-DOF, one more movement, translation or rotation
2219/39489 . . . Soft fingertip, electro rheological controlled fluid
2219/39491 . . . Each finger controlled by a controller
2219/39492 . . . Finger impedance control
2219/39493 . . . Passive compliant finger, array of resilient rods in tip
2219/39494 . . . Each finger has 4-DOF
2219/39495 . . . Active electromechanical compliance for each finger
2219/39496 . . . 3-Fingered hand
2219/39497 . . . Each finger can be controlled independently
2219/39498 . . . Each finger has force torque sensor in tip of finger
2219/39499 . . . 4-Fingers with each 6-DOF
2219/39501 . . . 5-Fingers with each 4-DOF
2219/39502 . . . 4-Fingers with each 3-DOF
2219/39503 . . . 4-Fingers with each 4-DOF
2219/39504 . . . Grip object in gravity center
2219/39505 . . . Control of gripping, grasping, contacting force, force distribution
2219/39506 . . . Grip flexible wire at fixed base, move gripper to top of wire and grip
2219/39507 . . . Control of slip motion
2219/39508 . . . Reorientation of object, orient, regrasp object
2219/39509 . . . Gripping, grasping, links embrace, encircle, envelop object to grasp
2219/39511 . . . Reorient, rotate object in hand between fingers by action of fingers
2219/39512 . . . Whole hand manipulation, use of fingertips and hand surface
2219/39513 . . . Tip prehension grasp, grasp with tip of fingers
2219/39514 . . . Stability of grasped objects
2219/39515 . . . Grapple object, grip in compliant mode, self alignment of fingers and object
2219/39516 . . . Push align object against wall, detect each time distance from grip point to wall
2219/39517 . . . Control orientation and position of object in hand, roll between plates
2219/39518 . . . Rolling contact between fingers, robot arms and object
2219/39519 . . . Concurrent grasp, all forces converge in one point
2219/39521 . . . Pencil grasp, forces act in two points, along line of intersection of two planes
2219/39522 . . . Regulus grasp, forces do not intersect at all
2219/39523 . . . Set holding force as function of dimension, weight, shape, hardness, surface
2219/39524 . . . Power grasp, between thumb and four fingers, acting as a virtual middle finger
2219/39525 . . . Lateral grasp, between thumb and four fingers, acting as virtual index finger
2219/39526 . . . Three fingers used, thumb, index, middle finger for lateral precision
2219/39527 . . . Workpiece detector, sensor mounted in, near hand, gripper
2219/39528 . . . Measuring, gripping force sensor build into hand
2219/39529 . . . Force, torque sensor in wrist, end effector
2219/39531 . . . Several different sensors integrated into hand
2219/39532 . . . Gripping force sensor build into finger
2219/39533 . . . Measure grasping posture and pressure distribution
2219/39534 . . . By positioning fingers, dimension of object can be measured
2219/39535 . . . Measuring, test unit build into hand, end effector
2219/39536 . . . Planning of hand motion, grasping
2219/39537 . . . First slide object on table in order to be able to grasp it, grasp it
2219/39538 . . . Rotate object with one or more fingers, while sliding on table
2219/39539 . . . Plan hand shape
2219/39541 . . . Place fingers to reorient object while grasping
2219/39542 . . . Plan grasp points, grip matrix and initial grasp force
2219/39543 . . . Recognize object and plan hand shapes in grasping movements
2219/39544 . . . Fuzzy dynamic programming, generate trajectory of finger during tracking
2219/39545 . . . Trajectory generation for smoothly grasping moving object
2219/39546 . . . Map human grasps to manipulator grasps
2219/39547 . . . Program, plan gripping force, range and speed
2219/39548 . . . Enter interactively parameter for gripper, then teach movement
2219/39549 . . . Structure, hand has connector for power supply and control signals
2219/39551 . . . Pivoting gripper, so part takes always vertical orientation
2219/39552 . . . Stewart platform hand, parallel structured hand
2219/39553 . . . Dual gripper, two heads to pick up different objects
2219/39554 . . . Gripper is formed by flexible tube, embraces object like a finger
2219/39555 . . . Revolver with several grippers, hands
2219/39556 . . . Control system build into hand itself
Robotics, robotics mapping to robotics vision

- Use electromagnetic attraction to bring robot hand in contact with workpiece
- Extract, insert objects by controlling fingers, dexterous
- Grip, grasp non rigid material, piece of cloth
- Task, tool manipulation
- Tool guidance along path
- Passive compliant hand, wrist
- Wrist, flexible wrist
- Magnetically levitated wrist
- Active electromechanical compliance for wrist
- Axis wrist
- Robotics, robotics mapping to robotics vision
- Laser color indicates type of machining
- Camera, robot follows direction movement of operator head, helmet, headstick
- Move end effector so that image center is shifted to desired position
- Window function, only a specific region is analyzed
- Vision, analyse image at one station during manipulation at next station
- Placing, palletize, un palletize, paper roll placing, box stacking
- Optimize sequence of pick and place operations upon arrival of workpiece on conveyor
- Place a box, block in a corner
- Remove and replace machine part, module
- Lay down, laying non rigid material, handle flat textile material
- Pick and place by chain of three manipulators, handling part to each other
- Kitting, place parts from belt into tray, place tray on conveyor belt
- Gripping workpiece to place it in another place
- Soccer playing
- Kick a ball, leg and foot movement simulator
- Hockey playing, puck and paddle
- Ball in cup
- Placing and assembly, throw object correctly on table
- Batting, to redirect a projectile
- Snatching, dynamic pick, effector contacts object, moves with object
Carry container with liquid, compensate liquid vibration, swinging effect
Move tip of arm or carried object on surface, wall, constraint
Turn crank, handle, link around fixed point
Fold flexible plate, non rigid material
Posicast, inverted pendulum, acrobat, balance rod
Sort objects, workpieces
Grasp parts from first bin, put them in reverse order in second bin
Grasp part, object through hole in wall
Docking, align object on end effector with target
Pick up pen and robot hand writing
Posicast, inverted pendulum, acrobat, balance rod, control unactuated joint, dof
Point with tip always to same remote target point
Slide, tumble, pivot object on surface with fingers of manipulator, graspless
Align hand on workpiece to pick up workpiece, peg and hole
Task is push, slide box
Tele-programming, transmit task as a program, plus extra info needed by robot
Tele-programming by graphical simulation
Tele-programming by direct instruction on new object, using vision and force sensors
Use known task for similar, like object, inform system of that likeness
By changing knowledge base directly
Modify tasks due to modular tooling, other fixture configuration, environment
Modify tasks due to use of different manipulator
Select stations with mouse to create process steps
Show grid locations with symbols of workstations
Graphical user interface for robotics, visual robot user interface
Generate concurrent tasks
Tasks are classified in types of unit motions
Show object with laser pointer, give oral command for action on, with object
Reactive planner, user is integral component of planner, interactive
Oop task planning, use three knowledge bases, world-, domain- for vision, plan base
Feedback of online failures to offline learned knowledge base
Offline task learning knowledge base, static planner controls dynamic online
Generating possible sequence of steps as function of timing and conflicts
Consider each part to be assembled as an agent, behaving autonomously
For assembly
Using graph grammars and fuzzy logic
Task planning
From vision detected initial and user given final state, generate tasks
Translate goal to task program, use of expert system
Learn by operator observation, symbiosis, show, watch
Virtual mecanism, like slider to constraint movement in task space
Task oriented virtual tool, developed for task, assists operator in task
Virtual internal model, derive from forces on object, motion of end effector
Trajectory planning in virtual space
Manipulate virtual object, for trajectory planning of real object, haptic display
Indicate, select features on display, remote manipulator will execute
During manipulator motion, sensor feedback to adapt model in memory
Overlay real time stereo image of object on existing, stored memory image argos
Virtual landmarks, reference points for operator
Virtual tape measure, indicate distance between end effector and destination
Virtual tether, line on display connects end effector to destination point
Virtual graphic 3-D pointer, manipulator commands real manipulator
Virtual reality control, programming of manipulator
Haptic joystick with force feedback based on accelerometer included in joystick
Force sensation of slave converted to movement of chair for operator
Force sensation of slave converted to vibration for operator
Slave force converted to shape display, actuated by fingers, surface is force image
Stereo audio and vision
Force sensation feedback from simulated tool
Scaled feedback of forces from slave to master and master to slave
Force from slave converted to a digital display like fingers and object
Pain sensation feedback, impinge air on, squeeze, vibrate, stimulate fingers
Temperature sensation, thermal feedback to operator fingers
Slip, texture sensation feedback, by vibration stimulation of fingers
Force sensation feedback from slave
Force sensation of slave converted to audio signal for operator
Telepresence, teletaction, sensor feedback from slave to operator
Variable time delay, through internet
Predict locally machining forces from model to control remote machine
Local intelligence for global planning, remote intelligence for tuning
Time delay, problems caused by time delay between local and remote
Deictic, using a sign language, point finger to reach, close hand to grasp
Teleassistance, operator assists, controls autonomous robot
Tele-operation, computer assisted manual operation

- Micromanipulation
  - fine, hand for gripper
  - Control modes, velocity for coarse, position for operator during manipulation
  - Autonomous manipulation, computer assists operator during manipulation
  - Control modes, velocity for coarse, position for fine, hand for gripper

- Operation
  - Tele-operation, computer assisted manual operation
  - Snake arm, flexi-digit robotic manipulator, a Portable robot
  - Design of controller
  - Design of controller.

- Fault recovery from task execution errors
- Micromanipulation
  - Robot teleoperation through internet
  - Inclination, tilt of operator seat, chair serves as control command, like handle
  - Encode operator actions into symbolic commands for transmission to remote

- Surface display, virtual object translated into real surface, movable rods
- Nano-manipulation
  - Distributed top, resource availability in network

- Switch between simulated display of remote site, and actual display
- Nano-manipulation
  - Distributed top, resource availability in network

- Simulated display of remote site, driven by operator interaction
- Nano-manipulation
  - Distributed top, resource availability in network

- Display of actual situation at the remote site
- Nano-manipulation
  - Distributed top, resource availability in network

- Set a common coordinate system for all remotely controlled robots
- Nano-manipulation
  - Distributed top, resource availability in network

- Stop command transmission if no feedback signal received at remote site
- Nano-manipulation
  - Distributed top, resource availability in network

- Stop robot if no command received within interval
- Nano-manipulation
  - Distributed top, resource availability in network

- Robot teleoperation through internet
- Nano-manipulation
  - Distributed top, resource availability in network

- Inclination, tilt of operator seat, chair serves as control command, like handle
- Nano-manipulation
  - Distributed top, resource availability in network

- Encode operator actions into symbolic commands for transmission to remote
- Nano-manipulation
  - Distributed top, resource availability in network

- Nanomanipulation
  - Design of controller

- Operator can fine position in small area, free, but if contact, force feedback
- Nano-manipulation
  - Distributed top, resource availability in network

- Master has different configuration than slave manipulator
- Nano-manipulation
  - Distributed top, resource availability in network

- Tele-machining
- Nano-manipulation
  - Distributed top, resource availability in network

- Compliant teleoperation, operator controls motion, system controls contact, force
  - Decoupled coarse fine motion coordination
  - Reachability control, permits slave to reach commanded position

- Indexed position control, master controls only small part of slave space
- Nano-manipulation
  - Distributed top, resource availability in network

- Position control with scaling, master small movement, slave large movement
- Nano-manipulation
  - Distributed top, resource availability in network

- Modes, coarse by rate controller, fine by position controller
- Nano-manipulation
  - Distributed top, resource availability in network

- Autonomous manipulation, computer assists operator during manipulation
- Nano-manipulation
  - Distributed top, resource availability in network

- Control modes, velocity for coarse, position for fine, hand for gripper
- Nano-manipulation
  - Distributed top, resource availability in network

- Micromanipulation
- Nano-manipulation
  - Distributed top, resource availability in network

- Force reflective, impedance shaping tele operation
- Nano-manipulation
  - Distributed top, resource availability in network

- Tele-operation, computer assisted manual operation
- Nano-manipulation
  - Distributed top, resource availability in network

- Projecting light on floor to delimit danger zone around robot
- Nano-manipulation
  - Distributed top, resource availability in network

- Suppress, execute command depending on physical position of control panel
- Nano-manipulation
  - Distributed top, resource availability in network

- Contact with human allowed if under pain tolerance limit
- Nano-manipulation
  - Distributed top, resource availability in network

- Soft material covers links, arms for shock and pain attenuation
- Nano-manipulation
  - Distributed top, resource availability in network

- Detect contact, collision with human
- Nano-manipulation
  - Distributed top, resource availability in network

- Human robot coexistence
- Nano-manipulation
  - Distributed top, resource availability in network

- Detect position of operator, create non material barrier to protect operator
- Nano-manipulation
  - Distributed top, resource availability in network

- Each fault condition has a different recovery procedure
- Nano-manipulation
  - Distributed top, resource availability in network

- Multiple arm systems
- Nano-manipulation
  - Distributed top, resource availability in network

- Redundant serial manipulators, kinematic fault tolerance
- Nano-manipulation
  - Distributed top, resource availability in network

- Parallel structured modules, more joints than DOF
- Nano-manipulation
  - Distributed top, resource availability in network

- Dual redundant actuators
- Nano-manipulation
  - Distributed top, resource availability in network

- If speed is important processors execute each different code, otherwise same code
- Nano-manipulation
  - Distributed top, resource availability in network

- Fault tolerant, if one joint, actuator fails, others take over, reconfiguration
- Nano-manipulation
  - Distributed top, resource availability in network

- Two-way clutch for joint, prevents movement in unallowable direction
- Nano-manipulation
  - Distributed top, resource availability in network

- Record history, log of instructions sent from task planner to path planner
- Nano-manipulation
  - Distributed top, resource availability in network

- Individual emergency stop lines for each part of system
- Nano-manipulation
  - Distributed top, resource availability in network

- Check conditions before allowing unlocking of joint brake
- Nano-manipulation
  - Distributed top, resource availability in network

- Detect contact, proximity of other manipulators
- Nano-manipulation
  - Distributed top, resource availability in network

- Individual and common power cutoff switch for several robots
- Nano-manipulation
  - Distributed top, resource availability in network

- Lock arm if somebody is looking into the hand
- Nano-manipulation
  - Distributed top, resource availability in network

- If insertion force too high, alarm, stop for operator assistance
- Nano-manipulation
  - Distributed top, resource availability in network

- If robot gets a return signal, go to initial condition position
- Nano-manipulation
  - Distributed top, resource availability in network

- During start up, control robot with low speed, after a while gradually higher
- Nano-manipulation
  - Distributed top, resource availability in network

- Input control signals to control system and to model, compare their outputs
- Nano-manipulation
  - Distributed top, resource availability in network

- If one access robot fails, other pushes it out of the way
- Nano-manipulation
  - Distributed top, resource availability in network

- If deviation of compliant tool is too large, stop and alarm
- Nano-manipulation
  - Distributed top, resource availability in network

- Analytical redundancy, use available functional redundancy of model
- Nano-manipulation
  - Distributed top, resource availability in network

- Safety, dual clutched freewheel for joint, if error no movement possible
- Nano-manipulation
  - Distributed top, resource availability in network

- Lock mechanical arm if servo, cpu error, other arms remain free
- Nano-manipulation
  - Distributed top, resource availability in network

- Portable robot
- Nano-manipulation
  - Distributed top, resource availability in network

- Snake arm, flexi-digit robotic manipulator, a hand at each end
- Nano-manipulation
  - Distributed top, resource availability in network

- Parallel robot, structure
- Nano-manipulation
  - Distributed top, resource availability in network
2219/40236 . . . With opposing actuators on same joint, agonist, flexor, muscle
2219/40237 . . . Bus for communication with sensors
2219/40238 . . . Dual arm robot, one picks up one part from conveyor as other places other part in machine
2219/40239 . . . Common control box for several robot control boards and additional control boards
2219/40241 . . . Underactuated robot, has less actuators than number of DOF
2219/40242 . . . End effector with motor to provide a yaw, roll and pitch motion
2219/40243 . . . Global positioning robot
2219/40244 . . . Walking manipulator with integrated stewart, parallel arm
2219/40245 . . . Gripper on crawling device, smaller than two cm
2219/40246 . . . 6-DOF 3-pssp parallel manipulator
2219/40247 . . . Series manipulator mounted on parallel manipulator
2219/40248 . . . Manipulator on slide
2219/40249 . . . Whole arm manipulator, grip object not with end effector but with all links
2219/40251 . . . Ghrds generalized high dimensional robotic system, virtual decomposition
2219/40252 . . . Robot on track, rail moves only back and forth
2219/40253 . . . Soft arm robot, light, rubber, very compliant
2219/40254 . . . Serial to parallel, branching manipulator, one macro and several parallel arms
2219/40255 . . . End effector attached to cable for gravity balance suspension
2219/40256 . . . Large, heavy manipulator
2219/40257 . . . Flexible macro manipulator with rigid attached micromanipulator
2219/40258 . . . Robot can be fixed in orientation and height to ground, plurality of such points
2219/40259 . . . Set friction in each joint to optimal value
2219/40261 . . . Self reproducing, replicating fabrication machine, tools, structure, info for this
2219/40262 . . . Two link arm with a free, attached to base, and an active joint between links
2219/40263 . . . Dual use mobile detachable manipulator
2219/40264 . . . Human like, type robot arm
2219/40265 . . . Use of inflatable links, can easily be folded, compressed air for stiffness
2219/40266 . . . Resonant manipulator, springs cooperate with latches, motor only for lost energy
2219/40267 . . . Parallel manipulator, end effector connected to at least two independent links
2219/40268 . . . Master attached to tip of macro manipulator, controls slave micromanipulator
2219/40269 . . . Naturally compliant robot arm
2219/40271 . . . Underwater, submarine movable manipulator
2219/40272 . . . Manipulator on slide, track
2219/40273 . . . Wire manipulator, crane type manipulator with three wires
2219/40274 . . . Cebot segments are mobile manipulators, connected by manipulator arm self
2219/40275 . . . Manipulator mounted on satellite, space manipulator
2219/40276 . . . Aqua robot manipulator
2219/40277 . . . Hybrid, connect parallel manipulators in series, Stewart truss
2219/40278 . . . Compact, foldable manipulator
2219/40279 . . . Flexible arm, link
2219/40281 . . . Closed kinematic loop, chain mechanisms, closed linkage systems
2219/40282 . . . Vehicle supports manipulator and other controlled devices
2219/40283 . . . Reservoir with additional material on vehicle with manipulator
2219/40284 . . . Toolrack on vehicle with manipulator, toolchanger
2219/40285 . . . Variable geometry manipulator, camlock
2219/40286 . . . End effector with offset arm, to carry hose to feed material
2219/40287 . . . Workpiece manipulator and tool manipulator cooperate
2219/40288 . . . Integrate sensor, actuator units into a virtual manipulator
2219/40289 . . . Scara for coarse movement, xy table for fine movement
2219/40291 . . . Instead of two links, two eccentrically rotating disks for full circle working
2219/40292 . . . Manipulator is positioned by a crane to cover a large workpiece, extended range
2219/40293 . . . Gantry, portal
2219/40294 . . . Portable robot can be fixed, attached to different workplaces, stations
2219/40295 . . . Sensors at the elbow to detect obstacles
2219/40296 . . . Second arm can be attached to first arm, modular
2219/40297 . . . Macro manipulator and microhand, distributed positioning
2219/40298 . . . Manipulator on vehicle, wheels, mobile
2219/40299 . . . Holonic, made of similar modules, truss manipulator
2219/40301 . . . Scara, selective compliance assembly robot arm, links, arms in a plane
2219/40302 . . . Dynamically reconfigurable robot, adapt structure to tasks, cellular robot, cebot
2219/40303 . . . Arm somersaults over grid, place one hand on grid point, release other hand
2219/40304 . . . Modular structure
2219/40305 . . . Exoskeleton, human robot interaction, extenders
2219/40306 . . . Two or more independent robots
2219/40307 . . . Two, dual arm robot, arm used synchronously, or each separately, asynchronously
2219/40308 . . . Machine, conveyor model in library contains coo robot path
2219/40309 . . . Simulation of human hand motion
2219/40311 . . . Real time simulation
2219/40312 . . . OOP object oriented programming for simulation
2219/40313 . . . Graphic motion simulation for ergonomic analysis
2219/40314 . . . Simulation of program locally before remote operation
2219/40315 . . . Simulation with boundary graphs
2219/40316 . . . Simulation of human-like robot joint, restricted 3-D motion
2219/40317 . . . For collision avoidance and detection
2219/40318 . . . Simulation of reaction force and moment, force simulation
2219/40319 . . . Simulate contact of object and obstacle, reduce to pairs with only one contact
Simulation of human arm trajectories

Simulation with des, discrete event system

Modeling robot environment for sensor based robot system

Simulation, modeling of muscle, musculoskeletal dynamical system

Learn inverse kinematic model by variation, perturbation

Singular value decomposition

Calculation, inverse kinematics solution using damped least squares method

If joint near singularity, restore angle to start values, adapt other joints

Semi-singularity, movement in one direction not possible, in opposite direction is possible

Joint angle change constraint, singularity between elbow up and down

Identify degenerated directions, eliminate velocity component in that direction

Singularity, at least one movement not possible, kinematic redundancy

By fuzzy logic supervisor

By probability distribution functions pdf

Optimize multiple constraints or subtasks

Maximum distance criterium

Task priority redundancy

Avoid collision

Minimize energy

Minimize sum of gravitational torques of some joints

Optimize local torque

Configuration index, control, limits of joint movement

Minor measure

Compatibility index

Optimize manipulator velocity ratio function

Optimize condition number

Optimize manipulability measure function

Cooperation of hand arm, break down into two subsystems

Combination of priority, basic task, tip position, and task for link movement

Split robot into two virtual robot, origin of second equals tip of first

Singularity detection

Geometric, task independent

Kinetic energy, content and distribution

Compliance, design and operational issues

Inertial, from dynamic models

Constraint, physical limitations

Category of performance criteria

Elbow high or low, avoid obstacle collision with redundancy control

Two independent paths planned, interpolations for same robot, e.g. wrist and TCP

Position of robot platform as additional task

Configuration control, select other tasks by configuration of link positions

Elbow reaches its target position before the end effector

Redundant manipulator

Multipoint impedance control, redundant manipulator can touch several obstacles

Generate all possible arm postures associated with end effector position

Control trajectory to avoid joint limit as well as obstacle collision

Control end effector impedance

Control of trajectory in case of a limb, joint disturbance, failure

Control trajectory in case of distortion of visual input

Control trajectory in case of changed tool length

Moving center of mass and end effector for dynamic task of lifting heavy weight

Impact force on stationary end effector, move center of mass, no reaction to base

Keep center of mass fixed, no counterweight, no reaction on base

Manipulability

Control trajectory in case of joint limit, clamping of joint

Limit allowable area where robot can be taught

Correction, modification program by detection type workpiece

Optimize taught path by data acquisition followed by genetic algorithm

Compare offline taught point with online taught point, modify rest as function of error

Search around taught point until operation has succes, correct program

Modify without repeating teaching operation

Two channels between robot and teaching panel, rs232c and video

Use robot control language also to write non robotic user, application programs

Human to robot skill transfer

Programming, visual robot programming language

Learn natural high level command, associate its template with a plan, sequence

Combine offline with online information to generate robot actions

Compose movement with primitive movement segments from database

Intermediate code for robots, bridge, conversion to controller

Programming language for robots, bridge, universal, user oriented

Opto-electronic follow-up of movement of head, eyelds, finger to control robot

Selection of master-slave operation mode

Convert workspace of master to workspace of slave

Control button on master for quick movement, for fine slow movement

Master for walk through, slave uses data for motion control and simulation

Separate master controls macro and microslave manipulator

Master slave position control

Master slave rate control

Master slave, master is replica of slave

Intention learning
Robot brings object near operator, operator places object in correct position

Robot assists human in non-industrial environment like home or office

Sensor knowledge command fusion network, data and feature and action and constraint

Robot has multisensors surrounding operator, to understand intention of operator

Man robot interface, exchange of information between operator and robot

Semi active robot, cobot, guides surgeon, operator to planned trajectory, constraint

Planning for variable length tool, laser beam as tool

For cooperating manipulators

Presurgical planning, on screen indicate regions to be operated on

Task, motion planning of objects in contact, task level programming, not robot level

Motion planning for manipulator handling sheet metal profiles

Force controlled velocity motion planning, adaptive

Map task space to sensor space

Online motion planning, in real time, use vision to detect workspace changes

Sensing, vision based motion planning

Adaptive trajectory planning as function of force on end effector, bucket

Integrate sensing and action in planning

Using rapidly exploring random trees algorithm RRT-algorithm

Stochastic, probabilistic generation of intermediate points

Grid of preoptimised paths as function of target position, choose closest, fine adapt

Pass states by weighted transitions

Distributed, trajectory planning for each virtual arm

Decompose in motion planning for swarm of robots and motion planning for object to be transported

Extract minimum number of via points from a trajectory

Distributed search of attainable positions, parallel computed

Local, directly search robot workspace

Global, compute free configuration space, connectivity graph is then searched

Feasible map algorithm

Probabilistic backprojection

Voxel map, 3-D grid map

Conditional and iterative planning

Hierarchical planning, in levels

Decompose n-dimension with n-links into smaller m-dimension with m-1-links

Graph based

Bitmap based

Preprocess nodes with arm configurations, e-space and planning by connecting nodes

Continuous, smooth robot motion

Closest, nearest arm, robot executes task, minimum travel time

Evaluation function derived from skilled, experimented operator data

Maximum torque for each axis

Max velocity, acceleration limit for workpiece and arm jerk rate as constraints

Proximity of obstacles

End effector orientation error

End effector position error

Grid adaptive optimization

Minimum torque change model

Plan for even distribution of motor load of joints

Constant consumed energy, regenerate acceleration energy during deceleration

Shortest distance in time, or metric, time optimal

Minimum relative velocities

Criteria is lowest cost function, minimum work path

Plan for minimum time trajectory, at least one joint maximum torque

Virtual springs, impedance method

Using polytree intersection method

Using fuzzy logic performance, distances are fuzzy, very close to very far

Using gradient method

Using exact cell decomposition

Using genetic algorithm GA

Using potential fields

In presence of moving obstacles, dynamic environment

Collision, planning for collision free path

Plan path independent from obstacles, then correction for obstacles

Graph display of work area of robot, forbidden, permitted zone

Use graphic display, layout of robot path, obstacles to indicate interference

Search pattern according to type of assembly to be performed

Before assembly arrange parts

Find possible contacts

Using several tethered motors, attached to powersupply cable, move over surface

Generate goal regions in presence of uncertainty, interference

If physical limitation, execute regrasping steps

Sensing to task planning to assembly execution, integration, automatic

Coarse and fine motion planning combined

Assembly, polyhedra in contact

Gravity stable assembly, upper part cannot fall apart

Model manipulator by spheres for collision avoidance

Task to parameter designer, adapts parameters of impedance model as function of sensors

Neural network for object trajectory prediction, fuzzy for robot path

Inverse kinematics model controls trajectory planning and servo system

Hierarchical, learning, recognition level controls adaptation, servo level
G05B

2219/40497 . . . Collision monitor controls planner in real time to replan if collision
2219/40498 . . . Architecture, integration of planner and motion controller
2219/40499 . . . Reinforcement learning algorithm
2219/40501 . . . Using sub goal method of options for semi optimal path planning
2219/40502 . . . Configuration metrics
2219/40503 . . . Input design parameters of workpiece into path, trajectory planner
2219/40504 . . . Simultaneous trajectory and camera planning
2219/40505 . . . Adaptive posture planning as function of large forces
2219/40506 . . . Self motion topology knowledge, configuration mapping
2219/40507 . . . Distributed planning, offline trajectory, online motion, avoid collision
2219/40508 . . . Fuzzy identification of motion plans executed by operator
2219/40509 . . . Piano moving model
2219/40511 . . . Trajectory optimization, coarse for arm, medium for wrist, fine for finger
2219/40512 . . . Real time path planning, trajectory generation
2219/40513 . . . Planning of vehicle and of its manipulator arm
2219/40514 . . . Computed robot optimized configurations to train ann, output path in real time
2219/40515 . . . Integration of simulation and planning
2219/40516 . . . Replanning
2219/40517 . . . Constraint motion planning, variational dynamic programming
2219/40518 . . . Motion and task planning
2219/40519 . . . Motion, trajectory planning
2219/40521 . . . Alternative, allowable path substitution if arm movements not possible
2219/40522 . . . Display of workpiece, workspace, locus of robot tip in different planes, x y z
2219/40523 . . . Path motion planning, path in space followed by tip of robot
2219/40524 . . . Replace link, joint, structure by stewart platform to model flexibility
2219/40525 . . . Modeling only part of links or modules
2219/40526 . . . Modeling of links for each possible error or only certain error
2219/40527 . . . Modeling, identification of link parameters
2219/40528 . . . Ann for learning robot contact surface shape
2219/40529 . . . Neural network based on distance between patterns
2219/40531 . . . Ann for voice recognition
2219/40532 . . . Ann for vision processing
2219/40533 . . . Generate derivative, change of vibration error
2219/40534 . . . Generate derivative, change of position error
2219/40535 . . . Selective perception, retain only information needed for special task
2219/40536 . . . Signal processing for sensors
2219/40537 . . . Detect if robot has picked up more than one piece from bin; interlocked parts
2219/40538 . . . Barcode reader to detect position
2219/40539 . . . Edge detection from tactile information
2219/40541 . . . Identification of contact formation, state from several force measurements
2219/40542 . . . Object dimension
2219/40543 . . . Identification and location, position of components, objects
2219/40544 . . . Detect proximity of object
2219/40545 . . . Relative position of wrist with respect to end effector spatial configuration
2219/40546 . . . Motion of object
2219/40547 . . . End effector position using accelerometers in tip
2219/40548 . . . Compare measured distances to obstacle with model of environment
2219/40549 . . . Acceleration of end effector
2219/40551 . . . Friction estimation for grasp
2219/40552 . . . Joint limit
2219/40553 . . . Haptic object recognition
2219/40554 . . . Object recognition to track object on conveyor
2219/40555 . . . Orientation and distance
2219/40556 . . . Multisensor to detect contact errors in assembly
2219/40557 . . . Tracking a tool, compute 3-D position relative to camera
2219/40558 . . . Derive hand position angle from sensed process variable, like waveform
2219/40559 . . . Collision between hand and workpiece, operator
2219/40561 . . . Contactpoint between sensor surface and the normal, geometric probing
2219/40562 . . . Position and orientation of end effector, teach probe, track them
2219/40563 . . . Object detection
2219/40564 . . . Recognize shape, contour of object, extract position and orientation
2219/40565 . . . Detect features of object, not position or orientation
2219/40566 . . . Measuring, determine axis of revolution surface by tactile sensing, orientation
2219/40567 . . . Purpose, workpiece slip sensing
2219/40568 . . . Position and force and skin acceleration and stress rate sensors
2219/40569 . . . Force and tactile and proximity sensor
2219/40571 . . . Camera, vision combined with force sensor
2219/40572 . . . Camera combined with position sensor
2219/40573 . . . See integrated sensor, end effector, camera, proximity, gas, temperature, force
2219/40574 . . . Laserscanner combined with tactile sensors
2219/40575 . . . Camera combined with tactile sensors, for 3-D
2219/40576 . . . Multisensory object recognition, surface reconstruction
2219/40577 . . . Multisensor object recognition
2219/40578 . . . Impedance, mechanical impedance measurement
2219/40579 . . . Mechanical impedance, from motor current and estimated velocity
2219/40581 . . . Touch sensing, arc sensing
2219/40582 . . . Force sensor in robot fixture, base
2219/40583 . . . Detect relative position or orientation between gripper and currently handled object
2219/40584 . . . Camera, non-contact sensor mounted on wrist, indep from gripper
2219/40585 . . . Chemical, biological sensors
2219/40586 . . . 6-DOF force sensor
2219/40587 . . . Measure force indirectly by using deviation in position
2219/40588 . . . Three laser scanners project beam on photodiodes on end effector
2219/40589 . . . Recognize shape, contour of tool
2219/40591 . . . At least three cameras, for tracking, general overview and underview
2219/40592 . . . Two virtual infrared range sensors
2219/40593 . . . Push object and hold, detect moved distance
2219/40594 . . . Two range sensors for recognizing 3-D objects
2219/40595 . . . Camera to monitor deviation of each joint, due to bending of link
2219/40596 . . . Encoder in each joint
2219/40597 . . . Measure, calculate angular momentum, gyro of rotating body at end effector
2219/40598 . . . Measure velocity, speed of end effector
2219/40599 . . . Force, torque sensor integrated in joint
2219/40601 . . . Reference sensors
2219/40602 . . . Robot control test platform
2219/40603 . . . Infrared stimulated ultrasonic button on end effector, two fixed receivers
2219/40604 . . . Two camera, global vision camera, end effector neighbourhood vision camera
2219/40605 . . . Two cameras, each on a different end effector to measure relative position
2219/40606 . . . Force, torque sensor in finger
2219/40607 . . . Fixed camera to observe workspace, object, workpiece, global
2219/40608 . . . Camera rotates around end effector, no calibration needed
2219/40609 . . . Camera to monitor end effector as well as object to be handled
2219/40611 . . . Camera to monitor endpoint, end effector position
2219/40612 . . . 6-DOF ultrasonic or infrared external measurement
2219/40613 . . . Camera, laser scanner on end effector, hand eye manipulator, local
2219/40614 . . . Whole arm proximity sensor WHAP
2219/40615 . . . Integrate sensor placement, configuration with vision tracking
2219/40616 . . . Sensor planning, sensor configuration, parameters as function of task
2219/40617 . . . Agile eye, control position of camera, active vision, pan-tilt camera, follow object
2219/40618 . . . Measure gripping force offline, calibrate gripper for gripping force
2219/40619 . . . Haptic, combination of tactile and proprioceptive sensing
2219/40621 . . . Triangulation sensor
2219/40622 . . . Detect orientation of workpiece during movement of end effector
2219/40623 . . . Track position of end effector by laser beam
2219/40624 . . . Optical beam area sensor
2219/40625 . . . Tactile sensor
2219/40626 . . . Proprioceptive, detect relative link position, form object from hand contact
2219/40627 . . . Tactile image sensor, matrix, array of tactile elements, tixels
2219/40628 . . . Progressive constraints
2219/40629 . . . Manipulation planning, consider manipulation task, path, grasping
2219/41 . . . Servomotor, servo controller till figures
2219/41001 . . . Servo problems
2219/41002 . . . Servo amplifier
2219/41003 . . . Control power amplifier with data on data bus
2219/41004 . . . Selection gain according to selection of speed or positioning mode
2219/41005 . . . Update servo gain not for each microprocessor cycle, but after a certain displacement
2219/41006 . . . Change gain as function of speed and position
2219/41007 . . . Select gain as function of gear ratio
2219/41008 . . . Speed gain high, position gain low in speed mode and inverse in position mode
2219/41009 . . . Sum output of amplifiers with different gains
2219/41011 . . . Adapt gain as function of followup error, model can be used
2219/41012 . . . Adjust feedforward gain
2219/41013 . . . Lower gain in high frequency region
2219/41014 . . . Cubic raise of gain until friction overcome, then linear raise
2219/41015 . . . Adjust position and speed gain of different axis
2219/41016 . . . Adjust gain to maintain operating bandwidth for guaranteed servo performance
2219/41017 . . . High gain in narrow band of frequencies centered around frequency of rotation
2219/41018 . . . High gain for motor control during acceleration, low during deceleration
2219/41019 . . . Measure time needed from first to second speed, to adapt gain to aging condition
2219/41021 . . . Variable gain
2219/41022 . . . Small gain for small movements, large gain for large movements
2219/41023 . . . Large pd gain initially switched to smaller pd gain afterwards
2219/41024 . . . High gain for low command speed, torque or position error equals or near zero
2219/41025 . . . Detect oscillation, instability of servo and change gain to stabilize again
2219/41026 . . . Change gain as function of speed
2219/41027 . . . Control signal exponentially to error
2219/41028 . . . Select gain with memory, rom table
2219/41029 . . . Adjust gain as function of position error and position
2219/41031 . . . Raise gain at zero speed until position error or speed is zero, then normal gain
2219/41032 . . . Backlash
2219/41033 . . . Constant counter torque
2219/41034 . . . Two motors driven in opposite direction to take up backlash
2219/41035 . . . Voltage injection
2219/41036 . . . Position error in memory, lookup table for correction actual position
2219/41037 . . . With computer
2219/41038 . . . Compensation pulses
2219/41039 . . . Change compensation slowly, gradually, smooth error with filter
2219/41041 . . . Compensation pulses as function of direction movement
2219/41042 . . . Switch between rapid, quick feed and cut, slow workspeed feed backlash
2219/41043 . . . Memory table with motor current and corresponding correction for lost motion
2219/41044 . . . For several transducers a table, select table as function of transducer
2219/41045 . . . For several modes and feed speeds, a table, registers for several backlash
2219/41046 . . . Ftw compensation using adaptive inverse backlash model
2219/41047 . . . Recirculating ballnut, ballscrew, preloaded bearing
By injection of sinusoidal signal, superposed on
of value position counter
References, calibration positions for correction
Alignment, zeroing, nulling, set parallel to axis
Kind of compensation such as pitch error compensation
Compensation for changing stiffness, deformation of workpiece
Stiffness, deformation of slide, drive
For deformation of screw
Play in gear, screw backlash, lost motion
Backlash for linear deviations
Compensation for two, three axis at the same time, crosstalk
Lineary distributing pitch error over
interpolated distance, add pulses, smoothing
Reference screw, simulation axis, electronic simulated axis
Resolver or inductosyn correction
Keep nut at constant distance from screw
Correction screw
Measuring and feedback
With cam
Backlash for non orthogonal axis
Cam transmits movement to resolver
Tuning potentiometers and programming them
Learn, calibrate at start for indeterminate position, drive until movement
Calibrate at start if new screw or slide has been installed, new lookup table
For each replacement of a movable part, reload pitch error correction
Self tuning, test run, detect, compute optimal backlash, deformation compensation
Backlash acceleration compensation when
inversing, reversing direction
Cross coupled backlash for two other axis on reversing third axis
Approach position from same direction
Timer, speed integration to control duration of backlash correction
Upon reversing direction, lower, change gain
Compensation speed axis with changing, reversing direction, quadrant circle
Compensation pulses on inversion of direction of rotation, movement
Bang bang control
Determine switch point
If error too large, switch over to signal identification and servo correction
Align, calibrate control so that one pulse or signal represents certain movement
Alignment, zeroing, nulling, set parallel to axis
References, calibration positions for correction of value position counter
By injection of sinusoidal signal, superposed on reference
Removable interferometer, store exact position, needed drive current, temperature
References, calibration positions to adapt gain of servo
For several positions store dead zone in memory
Align stepping motor with driven valve
Automatic recalibration
Calibration by going to two extremes, limits, counting pulses, storing values
Stop, halt step, ac motor on certain excitation phase, after sensing a reference
Analog comparator
One comparator for both speed and position feedback
Start fine position after coarse position stopped
Coarse fine
to take over, transition, switch over
Coarse by hydraulic cylinder, fine by step motor superposed on piston
Controlled parameter such as gas mass flow rate
Drilling rate, feed rate
Vertical position and orientation with respect to vertical
Control parameter such as motor controlled by a torque signal
Compensation for path radius
Compensation for gravity, counter balance gravity
Compensation periodical disturbance, like chatter, non-circular workpiece
Compensation for instability
Cancel vibration during positioning of slide
Drift-compensation for servo, anti-hunt
Servo error compensation
Eliminating oscillations, hunting motor, actuator
Mechanical vibrations in servo, anti-hunt also safety, stray pulses, jitter
Correction inertia of servo
Nonlinear compensation
Compensate position as function of phase lag of drive motor
Compensation for current ripple of drive or transducer
Compensation for temperature variations of servo
Compensate vibration beam, gantry, feedback of speed of non driven end
Force compensation for non linearity of system
Enter manually a compensation, correction for a better positioning
Motor ripple compensation
Compensation non linear transfer function
Ann compensates output of pd controller
Avoid stray pulses, jitter, use two d-flipflops, or integrate pulse duration
Compensation of position for slip of ac motor
Torque compensation for levitation effect of motor
PI precompensation for speed loop
Serial precompensation during actual positioning
Repetitive control, adaptive, previous error from lookup memory
Compensation control, position error with data or subtracted to speed reference
function of sampling and computation time
system into phase margin
Different compensation for left and right image electronically
Compensate position error by shifting projected control path independent of load
oscillation, rigidity, inertia load
Adaptive filter frequency as function of independent from main servo
Compensation corrected by second servo loop
Compensation corrected by second servo independent from main servo
Adaptive filter frequency as function of oscillation, rigidity, inertia load
Control path independent of load
Compensate position error by shifting projected image electronically
Parallel compensation
Different compensation for left and right movement
Adapt coefficients of compensator to bring system into phase margin
Delay of compensation output signal as function of sampling and computation time
Compensator in feedback loop
Derivative compensation for speed loop, added or substracted to speed reference
Compensation control, position error with data from lookup memory
Repetitive control, adaptive, previous error during actual positioning
Serial precompensation
PI precompensation for speed loop
PID precompensation for position loop
PI precompensation for position loop
Compensation of lag during standstill
Compensation of lag during constant speed movement
Send reference data in inverse order to model, filter to get inverted phase
Lag
Inverse, reciprocal filter, transfer function, reduce lag in contouring
Compensate position error between two different axis as function of type of transducer
Several axis, compensation for load for several axis at the same time
Cancel vibration by positioning two slides, opposite acceleration
Compensation for different response times, delay of axis
Active damping of tool vibrations by cross coupling
Axis error, one axis is corrected on other axis
Cross coupled feedback, position change one axis effects control of other
Adaptive prefiltering
Adaptive postfiltering
Fuzzy precompensation of pid, pd
Feedforward compensation of pid
Fuzzy compensation of statecontroller
Structure, compensation circuit after comparator in loop
Lead-phase compensation, lag-phase compensation servo
Compensation circuit for input, reference, before comparator
Compensation circuit in speed feedback loop
Lookup table, memory with certain relationships
Lookup table with position command, deviation and correction value
Lookup table for load, motor torque as function of actual position error
Lookup table with compensation as function of reference and feedback value
For surface deviations from reference surface
Gains for pid compensator as function of xy position
Lookup table for load, motor torque as function of actual position
Lookup table for current as function of actual position
Lookup table for speed as function of actual position error
Two lookup tables, for forward and reverse movement
Command preshape, guidance, reference for better dynamic response, forcing feedforward
Posicast, break reference into two parts, better settling time
To compensate path, track error, calculate, use compensated reference
Fuzzy shaping
Modified command filtering
Ann shaping, objective position, trajectory is shaped by ann
Shaping a bang-bang input
2219/41225 . . . Profile generator for reference and for feedforward torque
2219/41226 . . . Zero vibration and zero derivative input shaper ZVD
2219/41227 . . . Extra insensitive input shaper, some vibration allowed
2219/41228 . . . Frequency of commutation updates depends on motor speed
2219/41229 . . . Adding a vibration, noise signal to reference signal of position, speed or acceleration
2219/41231 . . . Using impulse shaping filter
2219/41233 . . . Feedforward simulation filter, with model
2219/41234 . . . Design, modeling of position controller
2219/41235 . . . Design, modeling of motion controller
2219/41236 . . . Use of sfc sequential function charts for specification
2219/41237 . . . Use of petrinets for verification, simulation
2219/41238 . . . Design with control bandwidth beyond lowest natural frequency
2219/41239 . . . Lyapunov direct controller design
2219/41241 . . . Anti-coincidence, synchronizer
2219/41242 . . . Pulse height modulation PHM
2219/41243 . . . Prevent, detect overflow of counter
2219/41244 . . . Dead band, zone
2219/41245 . . . Discrimination of direction
2219/41246 . . . Modulate command according to hystereris so that ideal curve is followed
2219/41247 . . . Servo lock
2219/41248 . . . Adapting characteristics of servo
2219/41249 . . . Several slides along one axis
2219/41251 . . . Servo with spring, resilient, elastic element, twist
2219/41252 . . . Avoid housing vibration, slide and auxiliary slide controlled with opposite phase
2219/41253 . . . From measured signature, select in database corresponding servo valve type
2219/41254 . . . Avoid cumulative measuring, calculation errors, sum remainder
2219/41255 . . . Mode switch, select independent or dependent control of axis
2219/41256 . . . Chattering control
2219/41257 . . . Display of gain
2219/41258 . . . Single position detector for plural motors driving a single load
2219/41259 . . . Coupling, clutch
2219/41261 . . . Flexible coupling between carriage, slide and actuator, motor
2219/41262 . . . Binary summing of motions, by stacking or using levers
2219/41263 . . . Switch control mode of spindle drive as function of contouring, spindle orientation
2219/41264 . . . Driven by two motors
2219/41265 . . . To avoid backlash
2219/41266 . . . Coupling, clutch and brake unit
2219/41267 . . . Servo loop with stepping motor, see figure SE-twelve
2219/41268 . . . Two cascade slides controlled in opposite direction to avoid local wear
2219/41269 . . . Ballscrew and ball spline nut driven synchronously or independently
2219/41271 . . . Drive in two directions
2219/41272 . . . Driven by two stepmotors with different resonance frequency
2219/41273 . . . Hydraulic
2219/41274 . . . Flywheel as power buffer
2219/41275 . . . Two axis, x y motors controlled simultaneously, no contouring, quick move at 45-degrees
2219/41276 . . . Displacement as function of width, amplitude pulse to motor
2219/41277 . . . Separation of position drive controller and motor amplifiers
2219/41278 . . . Two current amplifiers, pumps for each direction of displacement, pushpull
2219/41279 . . . Brake
2219/41281 . . . Hydraulic actuated brake
2219/41282 . . . Magnetic brake
2219/41283 . . . Brake force does not load index axis, better positioning
2219/41284 . . . Brake by applying dc to ac motor
2219/41285 . . . Dynamic brake of ac, dc motor
2219/41286 . . . Brake motor before reversing motor
2219/41287 . . . Mechanical self braking
2219/41288 . . . Two brakes, one on motor axis, other on drive axis
2219/41289 . . . Motor direction controlled by relays
2219/41291 . . . Before switching relay, series semiconductor diminishes current to zero
2219/41292 . . . H-bridge, diagonal pairs of semiconductors
2219/41293 . . . Inverter, dc-to-ac
2219/41294 . . . Dc-to-ac converter
2219/41295 . . . Ac-to-ac converter frequency controlled
2219/41296 . . . Two data lines; one for drive controllers, other to communicate with central unit
2219/41297 . . . For cancelling magnetic field leakage generated by, e.g. voice coil motor
2219/41298 . . . Stepping motor and control valve and power cylinder and mechanical feedback
2219/41299 . . . Pneumatic drive, pressure controlled bellow extension
2219/41301 . . . Pilot valve, linear fluid control valve and power cylinder
2219/41302 . . . On off fluid valve and power cylinder
2219/41303 . . . Flow rate valve controls speed
2219/41304 . . . Pneumatic
2219/41305 . . . Bypass fluid flow, block it from motor
2219/41306 . . . Control valve with counteracting control pulses
2219/41307 . . . Motor drives hydraulic pump in direction needed for power cylinder
2219/41308 . . . Bellow formed by for linear actuators, each pressure controlled by motor
2219/41309 . . . Hydraulic or pneumatic drive
2219/41311 . . . Pilot valve with feedback of position
2219/41312 . . . Metering piston between switch to fluid supply and switch to power cylinder
2219/41313 . . . Electro rheological fluid actuator
2219/41314 . . . Electro rheological valve controls cylinder
2219/41315 . . . Feedback of position of pilot valve and of power cylinder
2219/41316 . . . Piezo valve
2219/41317 . . . Stepping motor and control valve and power cylinder
2219/41318 . . . Electro hydraulic drive, electric motor drives hydraulic actuator
2219/41319 . . . Ac. induction motor
2219/41321 . . . Brushless dc motor
2219/41322 . . . Vector, field oriented controlled motor
2219/41323 . . . Permanent magnetic synchronous actuator, motor
2219/41324 . . . Modular servo drive, simo drive
2219/41325 . . . Linear electric actuator for position combined with pneumatic actuator for force
2219/41326 . . . Step motor
2219/41327 . . . Linear induction motor
2219/41328 . . . Direct motor drive
2219/41329 . . . Dc motor
2219/41331 . . . Galvano driver
2219/41332 . . . Electromagnet driven core, position of core controlled
2219/41333 . . . Non linear solenoid actuator
2219/41334 . . . Electrostatic levitator
2219/41335 . . . Reluctance motor
2219/41336 . . . Voltage and frequency controlled ac motor
2219/41337 . . . Linear drive motor, voice coil
2219/41338 . . . High torque, low inertia motor, printed circuit motor
2219/41339 . . . Using, switch reluctance or asynchronous motor in, to stepping mode motor
2219/41341 . . . Ultrasonic motor
2219/41342 . . . Shape memory metal actuator
2219/41343 . . . Magnetostrictive motor
2219/41344 . . . Piezo, electrostrictive linear drive
2219/41345 . . . Micropositioner
2219/41346 . . . Micropositioner in x, y and theta
2219/41347 . . . Piezo cycloid motor
2219/41348 . . . Hydraulic pressure block
2219/41349 . . . 6-Dof combined magnetic fluidic floating motion stage 100-micrometer cube range
2219/41351 . . . Piezo impact force, rapid extension of small mass moves object a bit
2219/41352 . . . Alternative clamping dilation of piezo, caterpillar motion, inchworm
2219/41353 . . . Optical piezo electric element, light converted in movement
2219/41354 . . . Magnetic, thermal, bimetal peltier effect displacement, positioning
2219/41355 . . . Electro magnetic coil actuator, voice coil
2219/41356 . . . Variable speed transmission, Van Doorne, Reeves
2219/41357 . . . Belt
2219/41358 . . . Transmission, variable gear ratio
2219/41359 . . . Gearbox
2219/41361 . . . Differential
2219/41362 . . . Registration, display of servo error
2219/41363 . . . Excess in error, error too large, follow up error
2219/41364 . . . Excess in error for speed, follow up error for speed
2219/41365 . . . Servo error converted to frequency
2219/41366 . . . Linearization of embedded position signals
2219/41367 . . . Estimator, state observer, space state controller
2219/41368 . . . Disturbance observer, inject disturbance, adapt controller to resulting effect
2219/41369 . . . Two estimators
2219/41371 . . . Force estimation using velocity observer
2219/41372 . . . Force estimator using disturbance estimator observer
2219/41373 . . . Observe position and driving signal, estimate disturbance and speed
2219/41374 . . . Observe position and driving signal, predict, estimate disturbance signal
2219/41375 . . . Observe speed and select torque as function of position reference, to compensate torque
2219/41376 . . . Tool wear, flank and crater, estimation from cutting force
2219/41377 . . . Estimate cutting torque in real time
2219/41378 . . . Estimate torque as function of speed, voltage and current
2219/41379 . . . Estimate torque from command torque and measured speed
2219/41381 . . . Torque disturbance observer to estimate inertia
2219/41382 . . . Observe position from encoder, estimate speed with ann
2219/41383 . . . Observe current, voltage, derive position
2219/41384 . . . Force estimation using position observer
2219/41385 . . . Observe position from encoder, estimate speed, position with kalman filter
2219/41386 . . . System identifier adapts coefficients tables for state and observer controller
2219/41387 . . . Observe reference torque, position and feedback position, estimate contact force
2219/41388 . . . Observe input torque and feedback position, estimate reaction torque
2219/41389 . . . Estimate torque from command torque and feedback acceleration
2219/41391 . . . Flux observer, flux estimated from current and voltage
2219/41392 . . . Observer for each axis, link, freedom, gives greater speed
2219/41393 . . . Synchronize observer with pulse from encoder
2219/41394 . . . Estimate speed and position error from motor current, torque
2219/41395 . . . Observe actual position to estimate compensation torque
2219/41396 . . . Estimate acceleration from three phase current values
2219/41397 . . . Estimate voltage control signal as function of voltage control signal and position error
2219/41398 . . . Estimate twist between motor and load, observe motor position and speed
2219/41399 . . . Reduced order estimator
2219/41401 . . . Estimate position from max and min speeds in open loop
2219/41402 . . . Observe speed and driving signal, estimate speed
2219/41403 . . . Machine deformation estimator as function of commanded position
2219/41404 . . . Hysteresis, bang bang feedback of velocity
2219/41405 . . . Inverse kinematic, dynamic
2219/41406 . . . LQR linear quadratic regulator to calculate gain for several known variables
2219/41407 . . . Master changes resistor, slave restores value in order to follow master
2219/41408 . . . Control of jerk, change of acceleration
2219/41409 . . . Update position feedback during speed control
2219/41411 . . . Avoid integrator wind-up, saturation actuator by dead zone feedback for integral
2219/41412 . . . Bandwidth of velocity loop is just below natural frequency of drive support
2219/41413 . . . Forward kinematics
2219/41414 . . . Time delay control, estimate non linear dynamics, correct with time delayed input
Superposition of movement

... figure SE-two

counter OR absolute digital comparator, see
Servo loop with switch between difference of
see figure SE-one

Servo loop with absolute digital comparator,
Zero phase error tracking controller zpec
Servo loop with absolute digital comparator, see figure SE-one
Servo loop with switch between difference of
counter OR absolute digital comparator, see figure SE-two

... Position reference acceleration FFW for torque compensation
... Position generates force FFW combined with position error
... FFW friction compensation for speed error, derived from position reference
... Speed reference and derived position FFW to compensate delay of position control
... FFW tracking controller
... Position reference FFW for speed error compensation
... Inverse, feedforward controller is inverse of closed loop system
... Zero phase error tracking controller zpec
... Servo loop with absolute digital comparator, see figure SE-one
... Servo loop with switch between difference of counter OR absolute digital comparator, see figure SE-two

... Lookup table for nonlinear function synthesis
... Feedback signal is doubled, reference signal is doubled plus one
... Correction signal is different as function of sign of error
... Select feedback signal between detected position of motor and of driven load
... Resolution of feedback of incremental position decreases with velocity speed
... Eliminate, diminish delay in feedback speed
... Correction stored position while motor, power off, drive - encoder not connected
... Noise filter as function of rate of displacement, speed, for stabilisation
... Select a controller as function of large or small error
... Feedforward of acceleration
... Feedforward of torque
... Feedforward of position
... Feedforward of position and speed
... Mean value of previous feedforward values
... Delay position command as function of calculation time for feedforward, or order of system
... Feedforward of current
... Advance feedforward as function of delay rising torque, for large acceleration changes
... Feedforward FFW
... Adapt coefficients, parameters of feedforward
... Feedforward of speed and acceleration
... Feedforward of speed
... Feedforward of speed only during deceleration
... Position error FFW for compensation of speed
... Position reference FFW for compensation speed reference and speed error
... Position reference FFW for compensation speed reference
... Position reference FFW for compensation of position
... Speed reference FFW for compensation of speed error
... FFW of position and speed error to compensate torque
... Position reference acceleration FFW for torque compensation
... Position generates force FFW combined with position error
... FFW friction compensation for speed error, derived from position reference
... Speed reference and derived position FFW to compensate delay of position control
... FFW tracking controller
... Position reference FFW for speed error compensation
... Inverse, feedforward controller is inverse of closed loop system
... Zero phase error tracking controller zpec
... Servo loop with absolute digital comparator, see figure SE-one
... Servo loop with switch between difference of counter OR absolute digital comparator, see figure SE-two
... Superposition of movement
Stage controller, zpec and fuzzy smc and compensation controller

PIDAF, PID with acceleration and friction compensation

Pi position controller and fuzzy logic speed controller

Flps frequency locked steeping position control servo

Five point, hysteresis controller

Crono controller, fractional or fractal or non integer order robust controller

All denominator model, the model form is expanded in denominator taylor series

Differential feedback pd

Kind of servo controller

Pi regulator

I regulator

Adaptive control, adaptive nonlinear control

Adaptive pi

Real time adaptive control

Select servo parameter set from table for fixed linear working points

Adaptive pd

Adaptive robust controller

Adapt regulator as function of its output

Adapt model as function of difference between real and calculated position

Ann, error to pd, output pd to plant and also sets weights in ann

Fuzzy pd controller, with position and velocity inputs

Fuzzy pd controller with position and velocity inputs

Fuzzy pi control

Fuzzy p

Fuzzy position controller

Fuzzy pi and d control

Dynamic fuzzy position controller

Loop, p control for position loop

Pi control for speed

Pi current controller

Predictive fuzzy controller

General predictive controller GPC

Delta gpc, using derivative in time, predict over finite horizon

Stochastic predictive controller spc

Position and speed and current

Position and speed and current and force, moment, torque

Position, speed and acceleration

Feedforward combined with pid feedback

Position and speed and acceleration and current feedback

Position and current

Quasi smc, smc combined with other regulators

Observer combined with pid and zero phase error tracking fbw controller

Two clocks for each of the two loops

Position feedback and speed feedforward, speed from data of tape

Position and speed feedback, speed derived from position reference

Position feedback and speed feedback, speed measured with tacho

Two position loops

Hybrid, digital control sets reference, coefficients for quick analog, pid, control

Position, speed or current, combined with vibration feedback

Observer combined with pd

P position loop, fuzzy speed loop

Fuzzy position controller and smc for motor voltage control

Force control in one axis, velocity control in other axis

Position, speed and force feedback

Hybrid, analog loop, reference compensated by digital loop

Error between reference model and controller compensated with fuzzy controller

Position, speed and deflection feedback

Speed and force loop

I parallel to non linear controller

Quick but coarse loop and slow but fine loop, dexterity

Loop combinations, add a second loop, cascade control

Position and force control loop together

Position and current, torque control loop

Speed then pressure or force loop

First closed loop, then open loop

Add, substract i part of speed feedback as function of sign speed error

Dual mode servo, slow and precise, quick and coarse movement

First open, then closed loop to correct setpoint of open loop

Slow coarse loop followed by fine quick loop

Coarse position with microprocessor, fine with hardware centering, tracking

Coarse 8-bit positioning in closed loop, fine 10-bit in open loop

Switch from pi, if large error to disturbance bit in open loop

Switch from pi, if large error to disturbance mode control if small error

Switch from pid to bang-bang to energy dissipation as function of speed, error

Speed regulation starts only in braking range, less processor time needed

Always position loop, first open loop for speed, then also closed loop speed

Open loop for positioning, closed loop for calibration

Coarse is speed loop, fine is position loop

Change from pd, if small error, to bangbang if large error

Switch between motion and stall mode, if speed is below certain value

Position closed loop or open loop pressure control

Loop mode, dual mode incremental coarse, analog fine

Switch from continuous drive to pwm, near stop or out of acceleration period
2219/42116 . . . Switch from pid to pd or pd to pid
2219/42117 . . . Speed mode then stepping mode
2219/42118 . . . Breaking of control loop, closing open control loop
2219/42119 . . . Switch between motion and stall mode if actuator voltage current below limit
2219/42121 . . . Switch from bang-bang control to dead beat, finite time settling control
2219/42122 . . . First open loop, then closed loop
2219/42123 . . . Position loop then force, current loop
2219/42124 . . . Change over between two controllers, transfer error signal
2219/42125 . . . Switch from pi to p or to pd-controller
2219/42126 . . . Bumpless, smooth transfer between two control modes
2219/42127 . . . Timing, switch over on detection of marker on spindle
2219/42128 . . . Servo characteristics, drive parameters, during test move
2219/42129 . . . Teach, learn position table, model, for each reference a motor control output
2219/42131 . . . Speed model created by entering estimated speed at references
2219/42132 . . . Correct, modify position table, model if detected error too large
2219/42133 . . . Position references as function of time, correlated speed, acceleration in memory, signature
2219/42134 . . . Fuzzy logic tuning of controller as function of error
2219/42135 . . . Fuzzy model reference learning controller, synthesis, tune rule base automatically
2219/42136 . . . Fuzzy feedback adapts parameters model
2219/42137 . . . Automatic tune fuzzy controller
2219/42138 . . . Network tunes controller
2219/42139 . . . Tune fuzzy controller by three attributes: rise time, overshoot, settling time
2219/42141 . . . Filter error learning
2219/42142 . . . Fuzzy control learning of starting friction coefficient
2219/42143 . . . offline optimization of fuzzy controller
2219/42144 . . . Online tuning of fuzzy controller by ann
2219/42145 . . . Coarse tune with genetic algorithm, fine with gradient descent, hill climbing
2219/42146 . . . In each position, upper, lower drive current needed to move more, less, store mean
2219/42147 . . . Tune with genetic algorithm
2219/42148 . . . Position references as function of time, correlated noise, temperature in memory
2219/42149 . . . During learning relation between control and controlled signal, open loop
2219/42151 . . . Learn dynamics of servomotor system by ann
2219/42152 . . . Learn, self, auto tuning, calibrating, environment adaptation, repetition
2219/42153 . . . Inverse dynamics model idm, computed torque method
2219/42154 . . . Model itself controlled by position and speed loop
2219/42155 . . . Model
2219/42156 . . . Forward dynamics model fdm
2219/42157 . . . Reference model uses only output and input measurements
2219/42158 . . . Fuzzy model of cutting process of milling machine
2219/42159 . . . ARMA, AR autoregressive for poles, MA moving average model for zeros, in combination
2219/42161 . . . One model for load, one model for motor inertia
2219/42162 . . . Model reference adaptive control MRAC, correction fictive-real error, position
2219/42163 . . . Simulator
2219/42164 . . . Compensation of integration time of model
2219/42165 . . . Compensation of gain of speed control circuit for model
2219/42166 . . . Criterium is minimum jerk
2219/42167 . . . Minimum torque change
2219/42168 . . . Measuring of needed force for servo
2219/42169 . . . Decoder
2219/42171 . . . Velocity profile, variable gain, multiplication factors, rom ram
2219/42172 . . . Special code
2219/42173 . . . Acceleration deceleration
2219/42174 . . . Memory with position profile and force limits
2219/42175 . . . Velocity, speed points, profile and corresponding acceleration, delta v
2219/42176 . . . Motion profile
2219/42177 . . . Configuration memory for step motor
2219/42178 . . . Reduce cable connection by pre-memorized positions
2219/42179 . . . Normalize velocity profile, calculate real velocity from additional parameters
2219/42181 . . . Rom contains sin and cos table to drive step motor
2219/42182 . . . Memory is Rom and cos table to drive step motor
2219/42183 . . . Memory is Ram
2219/42184 . . . Master slave with feedforward for compensation of contour error
2219/42185 . . . Master slave with contour controller
2219/42186 . . . Master slave, motion proportional to axis
2219/42187 . . . Position mirror, axis, display, back of seat as function of position of seat, other axis
2219/42188 . . . Slave controlled as function of reference and actual position and derived speed of master
2219/42189 . . . Motion look up table as function of cam angle
2219/42191 . . . Adjust proportionality factor to optimize slave axis movement
2219/42192 . . . Each axis drive has own queue of commands, executed in synchronism
2219/42193 . . . Select between limit switches as function of current position and destination
2219/42194 . . . Derive position from command speed, integrate speed
2219/42195 . . . Position a stop, move workpiece against stop to cut stock, bar
2219/42196 . . . Follow dynamically contour warped surface with tool
2219/42197 . . . Brake as function of machining load, to keep total load on tool constant, avoid oscillation
2219/42198 . . . Step motor driven by step size and step duration data
2219/42199 . . . Fine position with gauge, coarse with limit switch, transducer
2219/42201 . . . Deriving speed from commanded position
2219/42202 . . . Square of distance
2219/42203  . . . Using a counter and a limit switch
2219/42204  . . . Absolute positions
2219/42205  . . . With potentiometer
2219/42206  . . . Block, stop pulses in one axis, not in other axis
2219/42207  . . . Generate points between start and end position, linear interpolation
2219/42208  . . . Set position of proximity switch
2219/42209  . . . Two slides, fine and quick, coarse and slow, piggyback, multirate positioner
2219/42211  . . . Command position by time value, proportional to total displacement
2219/42212  . . . Rotation over, selection of smallest, shortest angle, distance
2219/42213  . . . Position overshoot, axis still moves after stop
2219/42214  . . . Near desired position, control actuator by pulse in each clock, otherwise continuously
2219/42215  . . . Stop machine in a predetermined position
2219/42216  . . . Changing position range, stroke, between closed and fully open
2219/42217  . . . Time optimal position control
2219/42218  . . . Coarse and fine position control combined, each by ann
2219/42219  . . . Slow positioning with low pass, concurrent quick with high pass part of command
2219/42221  . . . Control position by equilibrium between spring and actuator force
2219/42222  . . . Compare reflected image from object with reference image, adjust object
2219/42223  . . . Number and frequency of pwm signals define mean position in time
2219/42224  . . . Process received reference to adapt it to range of servo
2219/42225  . . . Coarse and fine position control combined, added, superposed
2219/42226  . . . If deviation, return to desired position after a delay if within position range
2219/42227  . . . Using incremental control actuator
2219/42228  . . . Stop motor where torque will be maximum
2219/42229  . . . Shut off control, system, power on detection of zero or neutral position
2219/42231  . . . Detent, stop lock, current through motor in stop, locked, hold, blocked position
2219/42232  . . . Select, switch between long, extended and short range to position
2219/42233  . . . Pwm signal to low pass filter, compared to feedback position, if equal stop motor
2219/42234  . . . Regression ann to map position error to pulse width
2219/42235  . . . Adaptive pulsing, augment time duration until movement detected
2219/42236  . . . Use of a certain number of ac periods
2219/42237  . . . Pwm pulse width modulation, pulse to position modulation ppm
2219/42238  . . . Control motor position with direction signal and pwm signal for position
2219/42239  . . . Adaptive pulsing, take into account next cycle, command
2219/42241  . . . Select minimum value of two reference values
2219/42242  . . . Reference generator for position
2219/42243  . . . Enter velocity in reference generator, delivers position signals
2219/42244  . . . Enter acceleration, jerk, generator outputs acceleration, speed, position by integration
2219/42245  . . . Reference generates upper and lower range value at both sides of reference
2219/42246  . . . Add compensation to reference value
2219/42247  . . . Remote reference transmitted to servo
2219/42248  . . . Command reference limited, clipped, only between upper and lower values
2219/42249  . . . Relative positioning
2219/42251  . . . Control position of beam in coordination with xy slide
2219/42252  . . . Position beam to keep centerline
2219/42253  . . . Double resolution for one pulse of computer
2219/42254  . . . Resolution one axis different from resolution other axis
2219/42255  . . . Acceleration, deceleration time is a multiple of sampling time
2219/42256  . . . Sampling the signal
2219/42257  . . . Sampling time in fixed relation to timer interrupt
2219/42258  . . . Two sampling frequencies, for online measurements, for offline calculations
2219/42259  . . . Variable sampling rate as function of thermal displacement
2219/42260  . . . Two sampling frequencies, one for motion, one for stillstand
2219/42261  . . . Variable sampling rate as function of position error
2219/42263  . . . Different sample rates, multiple sample rates for the different loops
2219/42264  . . . Slow down sampling if power down is detected
2219/42265  . . . Sampling rate for sending reference values equals interpolation rate
2219/42266  . . . Variable sampling rate, slow at low velocity
2219/42267  . . . Stability analysis
2219/42268  . . . Safety, excess in error
2219/42269  . . . Inject, superpose test signal on reference, monitor functionality servo
2219/42271  . . . Monitor parameters, conditions servo for maintenance, lubrication, repair purposes
2219/42272  . . . Total movement is divided in several zones with different protection parameters
2219/42273  . . . On restart, power up, overload replace reference with feedback signal, free rotate
2219/42274  . . . On power failure keep last servoposition by cutting off air supply
2219/42275  . . . Alarm if working cycle fraction with values exceeding nominal exceeds threshold
2219/42276  . . . Action, on power failure, close pilot valve entirely by return spring
2219/42277  . . . If no position command in a period, servo to rest position, shut off power
2219/42278  . . . If direction bad, change direction sign or phase sequence automatically
2219/42279  . . . Allow temporary motor overload if temperature still under maximum, heat inertia
2219/42281  . . . If estimated temperature rise of motor is too high, inhibit motor
2219/42282  . . . If displacement rate of actuator exceeds limit, lower it
2219/42283  . . . Motor only actuated if hardware and software permission and control signal together
2219/42284  . . . Stop and brake motor
2219/42285  . . . Stop axis brake controlled
2219/42286  . . . Speed, contour controlled slow down of motor
2219/42287 . . . On feedback failure, use profile stored in memory during learning
2219/42288 . . . Limit, stop drive current if axis obstructed, blocked, force against stop
2219/42289 . . . Avoid overload servo motor, actuator limit servo torque
2219/42291 . . . Regenerate faulty feedback by last measurement after detection excess error
2219/42292 . . . If speed detection fails, regenerate speed from position signal
2219/42293 . . . Regenerate faulty feedback by using previous value, substitute
2219/42294 . . . Software monitoring of time delay of feedback pulses, feedback failure
2219/42295 . . . Detect augmenting torque of drive motor
2219/42296 . . . Detect diminishing torque of drive motor, below low limit
2219/42297 . . . Detect phase lag of driving motor
2219/42298 . . . Measure backlash, time difference between point A to point B and from B to A, if too large
2219/42299 . . . Measure current during first acceleration command
2219/42301 . . . Detect correct connection of servomotor to powersupply
2219/42302 . . . Detect insufficient acceleration, diminishing speed
2219/42303 . . . Detect no speeding up of motor
2219/42304 . . . Load, torque threshold as function of speed
2219/42305 . . . Detect loss of pulse step motor
2219/42306 . . . Excess in error, compare reference with feedback
2219/42307 . . . Compare actual feedback with predicted, simulated value to detect run away
2219/42308 . . . Watchdog or integrator to detect no change or excess in feedback
2219/42309 . . . Excess in speed
2219/42311 . . . Store working torque profiles as function of time, position, compare with real torque
2219/42312 . . . Compare feedback with upper and lower limit, store result as 0-1 if in tolerance
2219/42313 . . . Excess in error for speed and different sign of position and speed feedback
2219/42314 . . . Warning signals are send when excess in error for speed, acceleration, amplitude
2219/42315 . . . Two, double counter to check measurement
2219/42316 . . . Additional hardware to detect which part of feedback is defect, failed
2219/42317 . . . Redundant, two actuators
2219/42318 . . . Using two, more, redundant measurements or scales to detect bad function
2219/42319 . . . What kind of actuator failure
2219/42321 . . . Wrong direction or sign of measured value, eventually stop
2219/42322 . . . Emit dummy pulses, detect loss of pulses, feedback failure, wire brake, short
2219/42323 . . . Detect wire break, short circuit of feedback
2219/42324 . . . Axis breaking, between motor and slide, table
2219/42325 . . . Stalling of drive motor, overload
2219/42326 . . . Protection servo for saturation of amplifier
2219/42327 . . . Detect ballscrew wear
2219/42328 . . . Detect bearing, clamp wear
2219/42329 . . . Defective measurement, sensor failure
2219/42331 . . . Bad parameter configuration for spindle, gear ratio, encoder resolution
2219/42332 . . . Detect failure of servo controller
2219/42333 . . . Synchronization by opposite correction for both axis
2219/42334 . . . Synchronous tracking servo for biaxial positioning tables, contouring
2219/42335 . . . If one slave axis out of synchronisation, synchronise all other axes to that one
2219/42336 . . . To synchronize axis, adapt gain of each axis as function of max, min, average gain
2219/42337 . . . Tracking control
2219/42338 . . . Position tracking control
2219/42339 . . . Speed tracking control
2219/42341 . . . Force tracking control
2219/42342 . . . Path, trajectory tracking control
2219/42343 . . . Optimum, adaptive sliding mode controller
2219/42344 . . . Chattering alleviation control, chattering about switching surface
2219/42345 . . . VSTC variable structure tracking control
2219/42346 . . . Fuzzy sliding mode control fsmc
2219/42347 . . . Switch to a saturation control signal if deviation from switch line is too large
2219/42348 . . . Slimsoc sliding mode self organizing controller
2219/42349 . . . Sliding mode control with perturbation estimation smcpe
2219/42351 . . . PIYSC proportional integral compensated vsc
2219/42352 . . . Sliding mode controller SMC, select other gain
2219/42353 . . . Variable structure system, control VSS VSC
2219/43 . . . Speed, acceleration, deceleration control ADC
2219/43001 . . . Speed, feed, infeed, acceleration, stopping problems
2219/43002 . . . Acceleration, deceleration for forward, backward reciprocating movement
2219/43003 . . . Acceleration deceleration in presence of backlash, dynamic backlash
2219/43004 . . . Decelerate to follow desired velocity
2219/43005 . . . Corner distance variables to keep path when programmed speed changes
2219/43006 . . . Acceleration, deceleration control
2219/43007 . . . Acceleration from rest
2219/43008 . . . Deceleration and stopping
2219/43009 . . . Acceleration deceleration for each block of data, segment
2219/43011 . . . Shorter time by adjusting corner speed, avoid zero speed when engage corner
2219/43012 . . . Profile is defined by series of bits, for each actuator, sensor
2219/43013 . . . Ramp signal from division of sum of registers
2219/43014 . . . Calculate inertia ratio from full acceleration and full deceleration trial
2219/43015 . . . Calculate square root x
2219/43016 . . . Acceleration, deceleration as function of feed rate override
2219/43017 . . . Acceleration is larger than deceleration to compensate for friction
2219/43018 . . . Compensation, correction of acceleration, deceleration time
2219/43019 . . . Compensate acceleration for sudden change in load, shockless
2219/43021 . . . At several positions detect acceleration error, compensate for it
2219/43022 . . . Compensate for friction as function of position
2219/43023 . . . Switch from acceleration to deceleration if mid stroke speed not reached
2219/43024 . . . Parabolic velocity profile, linear acceleration, keep energy dissipation minimal
2219/43025 . . . Acceleration, deceleration is polynomial, derivative is zero on stop position
2219/43026 . . . Predict deceleration start from measured characteristics and actual performance
2219/43027 . . . Parabolic acceleration, deceleration trajectory at start, stop
2219/43028 . . . Switching points for trapezoidal form are stored in memory
2219/43029 . . . Acceleration larger than deceleration for safe stopping at slow speed
2219/43031 . . . Feed speed reduction dependent on tool surface
2219/43032 . . . Non symmetric acceleration profile
2219/43033 . . . Sinusoidal acceleration profile
2219/43034 . . . Form of profile, ramp, trapezoid, S-curve, exponential
2219/43035 . . . Vertical start and stop phase
2219/43036 . . . Velocity profile with given starting and stopping speed vector
2219/43037 . . . Position, speed as function of position is trapezoid
2219/43038 . . . Parabolic acceleration, constant speed, parabolic deceleration as function of position
2219/43039 . . . Time, exponential acceleration, constant speed, exponential deceleration as function of time
2219/43041 . . . Prediction, look ahead deceleration control, calculate start deceleration
2219/43042 . . . Convolution of speed curve with torque curve
2219/43043 . . . Normal and maximum deceleration mode, switch as function of position deviation, error
2219/43044 . . . Drive and brake alternative to decelerate and stop
2219/43045 . . . Max torque, acceleration, then variable, then reverse, variable then max deceleration
2219/43046 . . . Determine time constant from command speed and needed max acceleration torque
2219/43047 . . . If speed below reference, small acceleration, if above, large deceleration
2219/43048 . . . Step change in reference, soft start, smoothing reference
2219/43049 . . . Digital convolution for velocity profile, also successive convolution
2219/43051 . . . Translate generic motion description into acceleration profiles
2219/43052 . . . Set for each block time constant and speed target
2219/43053 . . . Slow acceleration, rapid deceleration
2219/43054 . . . Take up gear backlash during deceleration
2219/43055 . . . Same acceleration deceleration pattern for position and velocity loop
2219/43056 . . . Asynchronous acceleration between slow, fast axes, rotational, linear axes
2219/43057 . . . Adjust acceleration, speed until maximum allowable moment for axis
2219/43058 . . . Limitation of acceleration, permissible, tolerable acceleration
2219/43059 . . . Accelerate, decelerate all axis as function of maximum, min, average speed axis
2219/43061 . . . Maximum acceleration deceleration lookup table as function of distance
2219/43062 . . . Maximum acceleration, limit
2219/43063 . . . Acceleration deceleration as function of maximum allowable speed
2219/43064 . . . Brake, decelerate at least one axis at maximum
2219/43065 . . . Limitation of jerk
2219/43066 . . . Max centrifugal acceleration, especially for cm
2219/43067 . . . Reach maximum speed at zero acceleration
2219/43068 . . . Adapt acceleration as function of load, developed heat in motor
2219/43069 . . . Measure acceleration, derive limit torque, adapt acceleration
2219/43071 . . . Open closing acceleration deceleration control
2219/43072 . . . Position controlled opening profile
2219/43073 . . . Time controlled opening profile
2219/43074 . . . Control speed, acceleration so as to follow desired speed profile
2219/43075 . . . Two modes, one normal and one for obstruction by objects
2219/43076 . . . Switch from acceleration to constant speed as function of detected speed limit
2219/43077 . . . Limit switch starts braking, stop, no braking, low torque movement until end
2219/43078 . . . Near end position limit switch, brake by reversing, then slow until end limit
2219/43079 . . . Acceleration, deceleration controlled by switches along path
2219/43081 . . . Set parameters of profile generator, creep distance and speed, flight time
2219/43082 . . . Near end position limit switch, lower speed and brake
2219/43083 . . . Structure, step motor
2219/43084 . . . Acceleration deceleration circuit implemented in software, algorithm
2219/43085 . . . Acceleration-deceleration circuit before interpolator
2219/43086 . . . Acceleration-deceleration circuit after interpolator
2219/43087 . . . Stop valves to stop fluid flow of hydraulic drive cylinder
2219/43088 . . . Select out of plurality of acceleration profiles
2219/43089 . . . Rom, ram with speed and acceleration
2219/43091 . . . Ram with optimum motion curve
2219/43092 . . . Torque curve, wave stored in rom, ram
2219/43093 . . . Speed pattern, table together with timing data in ram
2219/43094 . . . Acceleration and deceleration together with their respective time
2219/43095 . . . Maximum speed and acceleration deceleration time constant as function of position
2219/43096 . . . Position, trajectory and speed stored in ram
2219/43097 . . . Table, rom, ram speed table
2219/43098 . . . Change ADC time constant during start and end of interpolation
2219/43099 . . . Select acceleration deceleration time constants as function of weight, load, position
2219/43101 . . . Change time constants acceleration, deceleration as function of feed rate override
2219/43102 . . . Time constant acceleration, deceleration as function of machining conditions
2219/43103 . . . Switch adc time constants as function of type of axis, spindle feed or position axis
2219/43104 . . . Minimize time constant based on operation program
2219/43105 . . . ADC time constants as function of type of axis rotational or linear
2219/43106 . . . Time constant acceleration, deceleration as function of temperature of motor
2219/43107 . . . Correction acceleration and deceleration as function of speed, time constants in rpm
2219/43108 . . . Delay stop command as function of error between reference and multiple of increments
2219/43109 . . . Adaptive stopping with correction for both directions
2219/43111 . . . Measure time needed from first to second speed, to adapt position command
2219/43112 . . . Using feedforward prediction of position
2219/43113 . . . Give stop order a certain number of motor rotations before end stop
2219/43114 . . . Detect position, speed or time of object between begin and end, adapt motion
2219/43115 . . . Adaptive stopping
2219/43116 . . . Calculate overshoot from supply voltage change, adapt motion
2219/43117 . . . Torque compensation as function of position reference, feedback of speed and position
2219/43118 . . . Adjust position reference as function of position reference, feedback of speed and position
2219/43119 . . . Adapt robot motion to machine speed as function of error from programmed speed
2219/43121 . . . Axis speed as function of probing signal during probing of workpiece
2219/43122 . . . Adapt speed, feed as function of duration of transmission of instruction
2219/43123 . . . Speed of cutter as function of position of feeder, probe
2219/43124 . . . Adapt speed as function of material, thickness, depth, volume, width, uniform surface quality
2219/43125 . . . Speed as function of size of chuck, diameter tool
2219/43126 . . . Pivoting speed of workpiece as function of inverse of work, machining time needed
2219/43127 . . . As a function of, select reference velocity as function of gear ratio
2219/43128 . . . Feed as function of number of press operations
2219/43129 . . . Speed as function of curvature, in curves, corners smaller than in straight line
2219/43131 . . . Adapt speed as function of lag, follow up error
2219/43132 . . . Rotation speed as function of minimum wave energy, toolwear, first learn for different speeds
2219/43133 . . . Delay movement start as function of lag, follow up error
2219/43134 . . . Feed or speed as function of magnetic characteristic, code, form of tool
2219/43135 . . . Reduce path speed near centre of axis
2219/43136 . . . Lower speed of indexing motor if door to turret lathe is open
2219/43137 . . . Constant path speed for combined rotational and linear movement
2219/43138 . . . Set speed by controlling position of pulley of variable transmission
2219/43139 . . . VCO variable frequency oscillator or two oscillators with different frequency
2219/43141 . . . Surface, path, tangential speed
2219/43142 . . . Control relative speed between two spindles
2219/43143 . . . ADC ramp and velocities are set by potentiometers which control digital valve
2219/43144 . . . Accelerate one slide and decelerate other slide to keep speed constant
2219/43145 . . . Machine first with low spindle speed, then with high speed, avoid chatter
2219/43146 . . . Control of speed, velocity of movement of tool as function of power of tool
2219/43147 . . . Control power of tool as function of speed, velocity of movement
2219/43148 . . . Rapid return, retract stroke
2219/43149 . . . Rapid approach, then slow, then pressure for clamping, bonding
2219/43151 . . . Rapid feed in, slow workspeed during entering material, then high work speed
2219/43152 . . . Feed in, transfer line, rapid traverse to work, grip speed
2219/43153 . . . Control depth of feed in by timer
2219/43154 . . . Quick feed in to workpiece without gauging, then normal feed with gauging
2219/43155 . . . Rapid speed for approach then slow speed for working
2219/43156 . . . Feed rate
2219/43157 . . . Feed rate
2219/43158 . . . Feedrate override
2219/43159 . . . Feedrate override only for x y, not for z or only for z and not for x y
2219/43161 . . . Second, independent feedrate override
2219/43162 . . . Motion control, movement speed combined with position
2219/43163 . . . Based on unit motions, primitive b-spline motions, time shifted and weighted
2219/43164 . . . Independent, uncoordinated motion control of several motors to initialise
2219/43165 . . . Superposition of special effects motion on normal motion
2219/43166 . . . Simulation of mechanical gear
2219/43167 . . . Distributed motion control
2219/43168 . . . Motion profile planning for point to point control
2219/43169 . . . Motor drives a mechanical cam
2219/43171 . . . Correction servo and constant velocity motor as input to differential, sum motion
2219/43172 . . . Change velocities on the fly during a motion
2219/43173 . . . Synchronize motion with scenery, sound
2219/43174 . . . Simulating cam motion mechanisms
2219/43175 . . . Motion in several blocks, for each part in open and part in closed loop
2219/43176 . . . Scale velocity profile
2219/43177 . . . Single cycle positioning, start, move, stop for single rotation
2219/43178 . . . Filter resonance frequency from acceleration pattern, derive new speed pattern
2219/43179 . . . Speed changes gradually from constant value to zero
2219/43181 . . . Reaching reference position by spiraling speed reference
2219/43182 . . . Speed control with feedback and as reference the programmed value
2219/43183 . . . Speed control, input is the reference, but no feedback
2219/43184 . . . From desired speed, derive delta positions during equal intervals
2219/43185 . . . Speed invariant motions, path accuracy independent of speed
2219/43186 . . . Pulses from handle, knob, hand wheel control speed
2219/43187 . . . Vector speed, ratio between axis, without feedback
2219/43188 . . . Vector speed with feedback
2219/43189 . . . Sum of squares
2219/43191 . . . Approximation
2219/43192 . . . Brake while driving to obtain very low speed, step wise movement, then stop
2219/43193 . . . Variable slope speed steps as function of position, pulse pump controller
2219/43194 . . . Speed steps, switch over as function of position
2219/43195 . . . Using a tri-phase motor and a step motor
2219/43196 . . . Using two motors
2219/43197 . . . Two axis at the same time
2219/43198 . . . Coupling and step motor
2219/43199 . . . Safety, limitation of feedrate
2219/43201 . . . Limit speed to allowable speed for all axis
2219/43202 . . . If collision danger, speed is low, slow motion
2219/43203 . . . Limitation of speed, permissible, allowable, maximum speed
2219/43204 . . . Different, dynamic current limits as function of speed
2219/43205 . . . General tape speed controls speed of axis
2219/43206 . . . Tape speed controls speed of axis
2219/45 . . . Nc applications
2219/45001 . . . Antenna orientation
2219/45002 . . . To application field of control
2219/45003 . . . Harvester
2219/45004 . . . Mining
2219/45005 . . . Registration machine, chart recorder
2219/45006 . . . Valves
2219/45007 . . . Toy
2219/45008 . . . Theatre
2219/45009 . . . Glassforming
2219/45011 . . . To be assigned
2219/45012 . . . Excavator
2219/45013 . . . Spraying, coating, painting
2219/45014 . . . Elevator, lift
2219/45015 . . . Roller blind, shutter
2219/45016 . . . Radar
2219/45017 . . . Agriculture machine, tractor
2219/45018 . . . Car, auto, vehicle
2219/45019 . . . Balancing wheels
2219/45021 . . . Wheel mounting
2219/45022 . . . Auto seat, dentist chair, roll wheel chair
2219/45023 . . . Align head lamps of car
2219/45024 . . . Simulation car ride
2219/45025 . . . Position, mount glass window, sunroof in car body
2219/45026 . . . Circuit board, pcb
2219/45027 . . . Masking, project image on wafer semiconductor, photo tracer
2219/45028 . . . Lithography
2219/45029 . . . Mount and solder parts on board
2219/45031 . . . Manufacturing semiconductor wafers
2219/45032 . . . Wafer manufacture; interlock, load-lock module
2219/45033 . . . Wire bonding, wire wrap
2219/45034 . . . Adjusting, trimming circuits on printed boards
2219/45035 . . . Printed circuit boards, also holes to be drilled in a plate
2219/45036 . . . Waterjet cutting
2219/45037 . . . Veneer cutting
2219/45038 . . . Cutting plotter
2219/45039 . . . Slitter, scoring
2219/45041 . . . Laser cutting
2219/45042 . . . Hot wire cutting, use of polystyrene or similar material
2219/45043 . . . EDM machine, wire cutting
2219/45044 . . . Cutting
2219/45045 . . . Maintenance, automatic storage and retrieval system
2219/45046 . . . Crane
2219/45047 . . . Sorting
2219/45048 . . . Packaging
2219/45049 . . . Forklift
2219/45051 . . . Transfer line
2219/45052 . . . Filling vehicle with material
2219/45053 . . . Coil, bobbin handling
2219/45054 . . . Handling, conveyor
2219/45055 . . . Assembly
2219/45056 . . . Handling cases, boxes
2219/45057 . . . Storage handling for disks or material
2219/45058 . . . Grinding, polishing robot
2219/45059 . . . Drilling robot
2219/45061 . . . Measuring robot
2219/45062 . . . Surface finishing robot
2219/45063 . . . Pick and place manipulator
2219/45064 . . . Assembly robot
2219/45065 . . . Sealing, painting robot
2219/45066 . . . Inspection robot
2219/45067 . . . Assembly
2219/45068 . . . Cutting robot
2219/45069 . . . Computer controlled automata, doll
2219/45071 . . . Aircraft, airplane, ship cleaning manipulator, paint stripping
2219/45072 . . . Sewer cleaning manipulator
2219/45073 . . . Microrobot
2219/45074 . . . Edge treating robot, machine
2219/45075 . . . Sewer repair
2219/45076 . . . Gas, fuel refilling
2219/45077 . . . Sculpturing manipulator
2219/45078 . . . Window cleaning, end effector contains detection and cleaning means
2219/45079 . . . Stripping robot, strip pieces of garments from table
2219/45081 . . . Tuning robot for amplifiers
2219/45082 . . . Sanding robot, to clean surfaces
2219/45083 . . . Manipulators, robot
2219/45084 . . . Service robot
2219/45085 . . . Space robot
2219/45086 . . . Brick laying, masonry robot
2219/45087 . . . Gymnast robot, acrobat
2219/45088 . . . Riveting robot
2219/45089 . . . Testing robot
2219/45091 . . . Screwing robot, tighten or loose bolt
2219/45092 . . . Analysing or chemical synthesis robot, moving samples from station to station
2219/45093 . . . Tacker robot, to join panels with nails, staples
2219/45094 . . . Milling robot
2219/45095 . . . Office messenger
2219/45096 . . . Polishing manipulator
2219/45097 . . . Cable harnessing robot
Metal
Electroforming, original form is covered with laser forming
Forming workpiece by using thermal energy, Carton forming
Deburring
Micromachining to micrometer precision
Boring
Machining blade, airfoil
Inertia friction welding
Milling
Saw
Press-brake, bending machine
Turret lathe
Laser drilling
Laser welding
Turning, lathe
Welding
Marking
Forging press, combined with furnace
Tapping
Thread cutting
Gear cutting
Etching, engraving, sculpturing, carving
Making, assembling truss structures
Measuring, indicating device having a needle relative to length, in pipes
Long, deep drill, with drill, bore diameter small relative to length, in pipes
Actuator to regulate position, flow, speed, process variable
Ultrasonic drill, mill, machining
Actuator to regulate position, flow, speed, process variable
Long, deep drill, with drill, bore diameter small relative to length, in pipes
Measuring, indicating device having a needle
Making, assembling truss structures
Etching, engraving, sculpturing, carving
Integrated manufacturing system ims, transfer line, machining center
Gear cutting
Thread cutting
Tapping
Notching
Making cams, cones
Tracing, tracking optical axis
Line detector with laser beam, adjustable predetermined cmm probe angle
Two mode switch over tracking as function of motion
Trace electric potential lines to control z speed or other operation
Second photocell in advance of first, to control paths to be followed
Use of help paths to go to different workpiece limit switches
Limit scanning surface by marks, stored limit, using photocell sensible to different colours
Command code in form of a sticker, operation, velocity
Command codes, marks along line to control trace groove always at bottom of groove
Edge detector is incorporated into machine
detects discontinuity during machining, welding, sewing machining, compare with detected
Detect edge during machining, welding, sewing
Edge detector is incorparated into machine
Trace groove always at bottom of groove
Command codes, marks along line to control operation, velocity
Command code in form of a sticker
Using a pannotograph
Using photocell sensible to different colours
Limit scanning surface by marks, stored limit, limit switches
Use of help paths to go to different workpiece paths to be followed
Second photocell in advance of first, to control speed or other operation
Trace electric potential lines to control z motion
Machine 3-D model by tracing two 2-D models
Two mode switch over tracking as function of predetermined cmm probe angle
Line detector with laser beam, adjustable optical axis
Nc machine tool, till multiple

Machine tool problems
Map unfolded surface on flat surface to make dies, composite objects, free form
Make two halves of tool, model at the same time
Modeling, making, manufacturing model to control machine, cmm
Map 2-D pattern on 3-D
Nc machine makes cams, model to control, or make a copy, on other machines
Making, forming 3-D object, model, surface
Making 3-D object with model in computer memory
Model stored in a memory of a prototype
Machine 2-D slices, build 3-D model, laminated object manufacturing LOM
Remove material by laser beam, air, water jet to form 3-D object
Deposit layers, cured by scanning laser, stereo lithography SLA, prototyping
Calculate number and form of 2-D slices automatically from volume on screen
Wire, strang laying, deposit fluid, welding, adhesive, hardening, solidification, fuse
Desktop manufacturing [DTM]; Solid freeform machining [SFM]; Solid freeform fabrication [SFF]
DTM desktop manufacturing, prototyping
Laser sintering of powder in layers, selective laser sintering SLS
Machine 3-D slices, to build 3-D model, stratified object manufacturing SOM
Deposit layer, machine, mill layer, then new layer, SMD solid deposit manufacturing
Photo masking, mask cures whole layer at one time, add wax, mill, new layer
3-D printing, layer of powder, add drops of binder in layer, new powder
LEM laminated engineering materials, like lom but first cut, then stack
By positioning plurality of rods, pins to form together a mold, maquette
SDM shape deposition manufacturing for multimaterial layers
SALD selective area laser deposition, vapor solidifies on surface
Rapid freeze prototyping, selectively deposit and rapidly freeze water layer by layer
Virtual rapid prototyping, create a virtual prototype, simulate rapid prototyping process
Project particles, laser beam to point using two, more jets, beams, ballistic particle
Bond layers with glue, solder, welding, brazing in LOM
Blanks or taken from roll of metal sheet
Changing design, use same prototype, add reinforcements where needed
Reconstruct boundary volume from stack of layer contours, sections
Use quality measures, build time, strength of material, surface approximation
Electro rheological fluid to build support for overhanging parts, particle jet
2219/49038 . . . Support help, grid between support and prototype, separate easily
2219/49039 . . . Build layer of different, weaker material between support and prototype
2219/49041 . . . Workpiece is surrounded by softer support material during machining
2219/49042 . . . Remove chips from probe, tool by blowing them away
2219/49043 . . . Control of lubrication
2219/49044 . . . Control preload of spindle bearing
2219/49045 . . . Relieve stress of workpiece after machining by vibration table
2219/49046 . . . Control flatness of deformable workpiece table
2219/49047 . . . Remove chips by tool up down movement, pecking
2219/49048 . . . Control of damping of vibration of machine base
2219/49049 . . . Coolant serves as lubrication and also to take away swarf, chips
2219/49051 . . . Heat treatment of workpiece, tempering
2219/49052 . . . Accessory, coolant
2219/49053 . . . Break chips, spiral chips, interrupt momentarily in feed during two or more rotations
2219/49054 . . . Active damping of tool vibration
2219/49055 . . . Remove chips from probe, tool by vibration
2219/49056 . . . Control of flow of fluid or temperature as function of speed for uniform coating
2219/49057 . . . Controlling temperature of workpiece, tool, probe holder
2219/49058 . . . Division algorithm, calculate inverse ratio of cutting process from parameters
2219/49059 . . . Machine with constant volume in time
2219/49061 . . . Calculate optimum operating, machining conditions and adjust, adapt them
2219/49062 . . . Adaptive control AC
2219/49063 . . . Adaptive control constraint ACC
2219/49064 . . . Fuzzy adaptive control
2219/49065 . . . Execute learning mode first for determining adaptive control parameters
2219/49066 . . . Geometric adaptive control
2219/49067 . . . Find optimum between production rate and quality, number of points and speed
2219/49068 . . . Minimum cost adaptive
2219/49069 . . . Adaptive control optimalisation ACO
2219/49071 . . . Cycle time reduction
2219/49072 . . . Action, withdraw, stop feed tool to prevent breakout or lower load
2219/49073 . . . Adapt machining parameters so as to keep temperature constant
2219/49074 . . . Control cutting speed
2219/49075 . . . Control depth of cut
2219/49076 . . . Reduce cutting speed if feed force below minimum level
2219/49077 . . . Control of feed and spindle, cutting speed
2219/49078 . . . Control of feed only
2219/49079 . . . Control cutting torque, force
2219/49081 . . . If obstruction, bad joint, move head aside and retry operation
2219/49082 . . . Maintain constant material removal rate
2219/49083 . . . If number of feed retractions exceeds a limit, repeat same instruction block
2219/49084 . . . Control roughness of surface
2219/49085 . . . CMP end point analysis, measure parameters on points to detect end of polishing process
2219/49086 . . . Adjust feeding speed or rotational speed of main spindle when load out of range
2219/49087 . . . Adjust parameter to compensate path deviation
2219/49088 . . . As a function of, regulate feed as function of material, tool
2219/49089 . . . Control feed as function of detected number of tools engaging simultaneously workpiece
2219/49091 . . . Control feed as function of detected diameter, cross section of workpiece
2219/49092 . . . Vary, change controlled parameter as function of detected power
2219/49093 . . . Adapt cutting speed as function of depth of cutting
2219/49094 . . . Feed as function of deviation of real from programmed position at fixed time intervals
2219/49095 . . . Of rigidity of workpiece
2219/49096 . . . Deviation of compliant mounted tool
2219/49097 . . . Material type of each layer to be drilled, to be joined
2219/49098 . . . As a function of machine operating speed and tool
2219/49099 . . . Cutting force, torque
2219/49101 . . . As function of tool speed
2219/49102 . . . Tool temperature
2219/49103 . . . Speed and feed
2219/49104 . . . Chip thickness
2219/49105 . . . Emitted noise of tool
2219/49106 . . . Feed as function of lateral movement of saw blade
2219/49107 . . . Optimize spindle speed as function of calculated motion error
2219/49108 . . . Spindle speed
2219/49109 . . . Control cutting speed as function of tool wire wear, measure diameter of wire
2219/49111 . . . Cutting speed as function of contour, path, curve
2219/49112 . . . Compensation alignment of cylindrical workpiece
2219/49113 . . . Align elements like hole and drill, centering tool, probe, workpiece
2219/49114 . . . Go to coarse programmed reference, detector for fine alignment
2219/49115 . . . Alignment by taking into account asymmetries in signal, for small offsets
2219/49116 . . . Align tool head with fixed line by actuating actuators along tool head slideways
2219/49117 . . . Alignment of surfaces to get them parallel
2219/49118 . . . Machine end face, control C-axis and X-axis
2219/49119 . . . Machine arc of circumference, as groove, cylindrical interpolation
2219/49121 . . . C-axis for turning, fifth axis for milling
2219/49122 . . . Multiclamping, to reduce dead times
2219/49123 . . . Simulation of clamping workpiece, modeling fixture and workpiece
2219/49124 . . . Determine clamping position from equipment specification and machining shape
2219/49125 . . . Open clamp if tool approaches clamp zone, close again afterwards
2219/49126 . . . Clamp piece to pallet using connectable power source
Variable clamping force as function of movement, force on workpiece
Determine maximum clamping force as function of allowable displacement workpiece
Clamps are movable along rod to desired positions
High force clamping along periphery
Control fixed clamping force
Variable chuck clamping force as function of spindle speed
Clamp, keep positioned slide, workspace stationary during machining
Active clamping, use servo to keep in position
Vacuum pads hold workpiece during machining
Store working envelop, limit, allowed zone
Adapt working envelop, limit, allowed zone to speed of tool
Alarm if outside zone
Detec near collision and slow, stop, inhibit movement tool
Shut off power, stop if outside working zone
Obstacle, collision avoiding control, move so that no collision occurs
Limit movement on an axis by setting limits
Spheres replace object, check first collision for large spheres, then small
Tool changing registers geometry of tool to avoid collision
Retract on collision with moving object, tool follows, yields to object
Adapt working envelop, limit to size workpiece
Ball end cutter interference, caused by tool shape, overcut part surface
Axis related interference, remove hidden surfaces
Feedhold, stop motion if machine door is open, if operator in forbidden zone
Avoid collision, interference between tools moving along same axis
Detect position of slide to change hover height of tool to avoid collision
On collision, reverse motor over certain angle, then stop to avoid bending
On collision, cut off motor, delay, again motor on, repeat to avoid bending
Limitation, collision, interference, forbidden zones, avoid obstacles
On near collision reduce speed
Avoid pinching of persons between moving and fixed part
Near end of position, lower power or speed of motor to safe value, at end normal
On collision, obstruction reverse drive, accelerate, cancel inertia
Stop, dwell in corner edge, allow for cooling, go on machining, better surface
Corner, making corner
Compensation relative movement between two commonly driven slides
Compensation for measured deviation of tool path, as function of length of path
Execute compensation only if workhead, module is connected
Compensate feed as function of measured values and manual introduced values
Compensation for temperature, bending of tool
Compensate for dressing amount
Compensate slide position as function of indexed workpiece spindle position error
Compensation for sidewise deviation of machined workpiece
Compensation position by use of separate cmm
Compensate for errors in cmm, especially mirror errors, not flat enough
Compensation of vibration of machine base due to slide movement
Runout, eccentricity, unbalance of tool or workpiece
Compensation of tool position as function of square of rotating speed of spindle
Compensation for reluctance of axis motors causing surface ondulation
Calculation, estimation, creation of error model using measured error values
Tapping, overshoot after reversal, elasticity compensation
Compensation height of tool as function of horizontal position of spindle head, bending
Compensation for bending of workpiece, flexible workpiece
Position error compensation as function of position of slide, control bearing pressure
Deflection, bending of tool
Control position of steady rest to compensate bending
Proportional compensation from middle to end of elongated workpiece
Bending of driven table, lag between real and commanded position
Bending, tilt spindle in bearings to compensate for bending
Create optical reference axis always kept parallel to reference optical block
Orthogonality of axis, deviation from 90-degree correction
Structure error, in slide or screw
Slide, guideway, robot arm deviation
Screw
Gear
Using lookup table, map, position and corresponding quasi static error
For non linear interpolation movement
Variable load, slide friction, irregular machine guides
For point to point positioning
For linear movement
Control of heat to compensate for dilatation, thermal displacement
Compensate with stored values as function of machining time
Compensation temperature, thermal displacement, use measured temperature
Compensate thermal displacement using measured distance
Preheat spindle by powering polyphase motor with monophase
Compensation by using temperature feelers on slide, base, workhead
Compensation dilatation using calculated temperature from velocity
Using lookup table, map, position error, temperature and position
Active thermal preload regulation for spindle
Estimate error from heat distribution model and drive current, correct error
Regulate temperature of coolant
Control of temperature of processor
Compensation of temperature increase by the measurement
Compensation of workpiece dilatation
Compensation temperature, thermal displacement
Control of scale
Rough cut at high speed
Remove workpiece portions left uncut, unmachined by tool with suitable shape
Identify and calculate uncut portions
Adapt machining conditions as function of workpiece cutting resistance
Cut, up or down cutting, cutting direction right, left
Cutting with trailing or leading edge of tool
Unidirectional or multidirectional cutting
Cutter, axis change over
Keep tool, probe at constant distance from workpiece surface
Limit penetration of drill into backup material, support
Machining depth relative to surface, constant depth
Keep constant distance even if hole present, avoid collision tool with hole
Control depth as function of grey level of scanned object, map of thickness
Translate thickness to be removed in dwell delay, then to corresponding speed
Depth, tool depth control
Surface tracking, following
Dimensions
2-5-D lace cutting, work in xy and increment in z, repeat
4-D
5-D
6-D
2-5-D pocket machining
3-D printing, layer of powder, add drops of binder in layer, new powder
Dressing started after number of workpieces machined
Dressing started if sparking out time to get correct surface is too long
Dressing as function of load of grinding wheel
Dress by conductive fluid between conductive grindstone and electrode
Two spindle drives for common workpiece
Position in space by controlling length of two, more cables, wires
High speed AC, induction spindle motor
Gear meshing, synchronize both with relative phase, then shift
Epicyclic movement of tool
Six or more linear drives to position x y z table
Two y axis to control also rotation
Endless belt with coupling, position tools simultaneously in both directions
Direct drive, without gear
Two drives at both sides of long tool
Separate, auxiliary indexing motor
Several x-y slides on single surface
X motor moves x and y axis, y motor only y axis
Two xy tables, on top and below workpiece, in between a cutting wire
Three linear actuators to position vertically and rotate horizontally
Four bar mechanism
Single motor for different drives, switch, change gears
Air bearing slide, hydraulic, electromagnetic bearing
Electromagnetic bearing also used as feed in one axis or positioning in two axis
Switch between continuous drive and index or stop mode
Four linear actuators to position x y table
Linear actuators on x y to position x y table, ballscrew drive on y to rotate
Floating, air, magnetic suspension xy table, Sawyer motor, xenetics
Oscillating, swinging feed drive, for grinding
Parallel link mechanism
Nanometric xy table
X y table positioned by vibration
Same control for double drive or slide
Frictionless rolling element
Two cascaded slides, large range sits on small range, piggyback
Linear control rotating movement kept constant
Two rotations gives cartesian coordinates, compact construction
Motor drives cam for very fine linear displacement, movement
Three linear actuators to position x y table
Large transmission ratio
Torque, moment, drive power amplifier, movement follower
Harmonic gear, transmission, strain wave gear
Switch between dual, double slide or double spindle mode
Motor and brake actuated together
Drive spindle motor at maximum, limit torque for rapid machining time
Identification workpiece by dimension, height, resistance value, but no code
Spindle identification in multispool spindle station
Probe identification
Identify workpiece and align, center workpiece at the same time
Identify material to be used, select between several
Part, workpiece, code, tool identification
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2219/49303</td>
<td>Tool identification and tool offset, compensation data together</td>
</tr>
<tr>
<td>2219/49304</td>
<td>Tool identification, code</td>
</tr>
<tr>
<td>2219/49305</td>
<td>Store, memory on tool with control and maintenance data</td>
</tr>
<tr>
<td>2219/49306</td>
<td>Derive kind of cutter from null load</td>
</tr>
<tr>
<td>2219/49307</td>
<td>Learn, learn operational zone, feed, speed to avoid tool breakage</td>
</tr>
<tr>
<td>2219/49308</td>
<td>Fuzzy classification of tool wear states</td>
</tr>
<tr>
<td>2219/49309</td>
<td>Main and secondary machining area, main spindle and satellite spindle</td>
</tr>
<tr>
<td>2219/49311</td>
<td>Select machining portion of workpiece, pivoting workpiece as function of correction needed</td>
</tr>
<tr>
<td>2219/49312</td>
<td>Fixture free machining</td>
</tr>
<tr>
<td>2219/49313</td>
<td>Machining about eccentric center different from rotational center of workpiece</td>
</tr>
<tr>
<td>2219/49314</td>
<td>Machine with oscillating workpiece, no full rotation</td>
</tr>
<tr>
<td>2219/49315</td>
<td>Machine first contour slowly, then remaining surface quickly, fast</td>
</tr>
<tr>
<td>2219/49316</td>
<td>Back-off grinding, during wheel retract, by deflection workpiece, after plunge</td>
</tr>
<tr>
<td>2219/49317</td>
<td>Traverse grinding, move along workpiece</td>
</tr>
<tr>
<td>2219/49318</td>
<td>Grind and simultaneous gauging, dwell, measure and final feed without gauging</td>
</tr>
<tr>
<td>2219/49319</td>
<td>Centerless machining, grinding, cutting</td>
</tr>
<tr>
<td>2219/49321</td>
<td>Reverse movement of tool to deburr</td>
</tr>
<tr>
<td>2219/49322</td>
<td>Cool to solidify material before machining it</td>
</tr>
<tr>
<td>2219/49323</td>
<td>Machine long, slender workpiece</td>
</tr>
<tr>
<td>2219/49324</td>
<td>Different starting point for each machining pass, to prevent dent formation</td>
</tr>
<tr>
<td>2219/49325</td>
<td>Combine punching and laser machining</td>
</tr>
<tr>
<td>2219/49326</td>
<td>Drill on laser machine, transfer to edm for operation on hole, adjust position</td>
</tr>
<tr>
<td>2219/49327</td>
<td>Combine punch and marker, engraving for workpiece</td>
</tr>
<tr>
<td>2219/49328</td>
<td>Laser machining and milling combined</td>
</tr>
<tr>
<td>2219/49329</td>
<td>Combine edm and milling</td>
</tr>
<tr>
<td>2219/49331</td>
<td>Laser drilling followed by laser cutting</td>
</tr>
<tr>
<td>2219/49332</td>
<td>First saw rough contours in workpiece then mill rest</td>
</tr>
<tr>
<td>2219/49333</td>
<td>Drilling and thread cutting by same machine</td>
</tr>
<tr>
<td>2219/49334</td>
<td>Combine turning, milling, grinding or other in one setup</td>
</tr>
<tr>
<td>2219/49335</td>
<td>Part, workpiece, inner, internal outer, external machining</td>
</tr>
<tr>
<td>2219/49336</td>
<td>Machine two mating, matching parts, at opposite ends of spindle, simultaneously</td>
</tr>
<tr>
<td>2219/49337</td>
<td>Machine holes in spherical nodes</td>
</tr>
<tr>
<td>2219/49338</td>
<td>Micromachining, workpieces small, around 1-mm or less</td>
</tr>
<tr>
<td>2219/49339</td>
<td>Machine simultaneous left and right, mirror part</td>
</tr>
<tr>
<td>2219/49341</td>
<td>Manual pocket machining, multipasses</td>
</tr>
<tr>
<td>2219/49342</td>
<td>Select between concentric and eccentric regions of a workpiece</td>
</tr>
<tr>
<td>2219/49343</td>
<td>Machining point symmetrical surfaces, revolving surfaces</td>
</tr>
<tr>
<td>2219/49344</td>
<td>Surface, 5-axis surface machining</td>
</tr>
<tr>
<td>2219/49345</td>
<td>Smooth and polish surface at the same time</td>
</tr>
<tr>
<td>2219/49346</td>
<td>3-Axis surface machining</td>
</tr>
</tbody>
</table>
Computer controlled movement of plotter is transferred to tool by pantograph
Machine alternative both sides of rib, net machining, against deformation
Adapt number of passes as function of tool wear
Multipasses, segmentation of cut, paraxial cutting
Machining step, fixing smallest step nibble machine, planer
Stop in one point, execute other operation and return back to first point
Repeating same operations for other coordinates
Stepwise milling, mill by advancing larger step then retract smaller step, repeat
Control of dwell time
Repeat same operations on machined part until machining reaches its finishing
Machine tool, machine tool null till machine tool work handling
Multislides, multispirals with multitool turret for each
Drill more holes simultaneously, adapt distance tools as function of detected image
Machine simultaneously two workpieces
Multitool at the same time, priority for one tool as function of machining parameter
Multiple chuck machining, chuck position change after each partial machining
Two parallel spindles, bi-spindle and two tool blocks sliding on same axis
Multiple polishing heads, oscillating and rotating
Multiple, multi tool head, parallel machining
Revolver head
Two spindles drive single large tool, cooperation of spindles
Multi slide and indexable multi workpiece spindles
Two spindles on same line, one for workpiece, other for tool, second tool on slide
Several, multi workpieces
Multi cutting, twin tools contact at same time workpiece, balance cutting
Turret with multiple workpiece holders, spindles, multiple fixed tools around it
Two programs, two slides, data second slide related to moving origin of first
Zero point floating
Zero, null offset
Configuration, null point on tool relative to null point on workpiece
Null point on tool relative to null point of toolholder, rotationcenter
Measure different null points, references of tool and store in memory
Go to reference, switches and dog to decelerate and to detect origin
Go to reference, switches and dog detect origin, combine with pulse from encoder
Go to reference plane, cube
Go to workpiece surface plane and store position
Beam detects x, y deviation on surface, compensates beam of position scanner
Go to pivotable, rotatable reference plane
Zero setting, go to reference with gauge
On one axis only, derive from inclined surface offsets for other axis
Align tool, tip with a calibration mark
Set search range about origin, select between different overlapping ranges
Go to reference point and measure a preset force, pressure, store position
Find center of circular mark, groove
Use either upper or lower limit for home control
Go to mechanical limit with low speed, until blocking of drive
Two probe, one on turret, serves also to calibrate second probe on bed
Measuring intensity of tool vibration
Return to origin, reference point, zero point, homing
Near zero detection
For speed
Combined axis jogging, following programmed shape instead of single axis
Control of level, horizontal, inclination of workholder, slide
Positioning, indexing
Jogging
Control machine as function of position, angle of workpiece
Turn workpiece axis perpendicular to turn axis of lathe
Orienting workpiece relative to tool
Machine non circular, non-round cross section, hexagonal, rectangular
Drill on skew surface
Make hollow workpiece with uniform wall thickness
Profile, for operation on I-, T-profiles or other elongated profiles
Compensation error by probing test, machined piece, post or pre process
During machining, measure previous part to compensate errors
Record profile error, used for next machining pass
Compensation of measuring errors due to machine with footprint
Measure deviation of workpiece under working conditions, machine correction
Probe, measure, verify workpiece, feedback measured values
Camera inspects workpiece for errors, correction of workpiece at desired position
Estimate trends from past measured values, correct before really out of tolerance
Fit base pattern into detected geometrical workpiece data, create whole program
Measure surface for thickness and store map in memory, machine surface
Test valve, object, store parameters, machine object to get wanted performance
2219/50069 . . . Reject workpiece if not machinable, material to be machined too large
2219/50071 . . . Store actual surface in memory before machining, compare with reference surface
2219/50072 . . . Machine workpiece again to correct previous errors
2219/50073 . . . Signature analysis, store forces during test, compare with real ones during assembly
2219/50074 . . . Purpose, workpiece measurement to control, adapt feed of tool
2219/50075 . . . To adapt, control force level at which machining will be considered as finished
2219/50076 . . . To derive from state of surface, the need to change used, worn tool
2219/50077 . . . Keep position by switching over to auxiliary power supply for resolver, encoder
2219/50078 . . . Single battery backup for all axis, encoders, resolvers
2219/50079 . . . Battery backup supplied over data, signal lines, to save cable
2219/50081 . . . On power loss, shut down axis using generated power from one braked axis
2219/50082 . . . UPS, no break to power actuator and move into safe condition
2219/50083 . . . Power loss, measures again loss of power
2219/50084 . . . Keep position, setup parameters in memory
2219/50085 . . . Realignment, search reference to reestablish position
2219/50086 . . . Microprocessor
2219/50087 . . . Rough, coarse and finish, fine machining
2219/50088 . . . Rough and finish machining simultaneously
2219/50089 . . . Finish allowance equals offset rough finish tool and bending work under rough
2219/50091 . . . Rough machining
2219/50092 . . . Sculptured part rough machining with the offset approach
2219/50093 . . . Sculptured rough machining with the contour map approach, make slices
2219/50094 . . . Optimize number of layers to be cut for contour map approach
2219/50095 . . . On tool breakage return to a reference then follow already machined path
2219/50096 . . . After interrupt, use tool path display to bring tool back on path
2219/50097 . . . After repair, dry run program until block before restart is detected
2219/50098 . . . After interrupt, interpolate with suitable startpoint different from stoppoint
2219/50099 . . . Before restart change jig, fixture with workpieces
2219/50101 . . . For fine machining, select tool and offset, block and restart midway
2219/50102 . . . Store history of operation, after power failure, restart from history, journal
2219/50103 . . . Restart, reverse, return along machined path, stop
2219/50104 . . . Before restarting program, restore machine status existing at stop time
2219/50105 . . . Display instructions to operator on how to restart machine
2219/50106 . . . Before allowing restart, check that machine condition is optimal
2219/50107 . . . Retract tool if end of drilling is detected
2219/50108 . . . Retract tool stepwise, same path, until safe boundary reached, then quick retract
2219/50109 . . . Soft approach, engage, retract, escape, withdraw path for tool to workpiece
2219/50111 . . . Retract tool along path, reengage along same path
2219/50112 . . . Retract tool to a point
2219/50113 . . . Short stroke, retract tool, safe distance from workpiece surface, hover height
2219/50114 . . . Select approach path as function of zone for tool slide
2219/50115 . . . Select complicated, combined approach path
2219/50116 . . . Select approach path out of plurality
2219/50117 . . . Select approach path as function of machining time
2219/50118 . . . Select as function of position of tool during cycle, optimum path
2219/50119 . . . Select between set of paths as function of interrupt nature
2219/50121 . . . Machining several workpieces with one or more tools in one setup
2219/50122 . . . Workpiece holder, chuck jaws, fixture setup
2219/50123 . . . Setup, automatic setup
2219/50124 . . . Automatic new setup when new program selected
2219/50125 . . . Configurable fixture, jig
2219/50126 . . . Position clamp, fixture by machining head itself
2219/50127 . . . Modular fixture, use of clamps and locators, the latter also for positioning
2219/50128 . . . Reference free part encapsulation, fixture using molten filler and cube
2219/50129 . . . Setup machines as function of process model, control strategy for optimum use of machines
2219/50133 . . . Setup as function of tool position in manufacturing center
2219/50132 . . . Jig, fixture
2219/50133 . . . With optical beam, tool crosses beam
2219/50134 . . . Tool pushes reference plane, or vice versa, reverse motion until again zero
2219/50135 . . . Tool touches box, sensor to give a contact signal
2219/50136 . . . With sensor, potentiometer to measure relative displacement
2219/50137 . . . Contact in probe, touch probe to detect contact, touch trigger
2219/50138 . . . During setup display is red, after setup display is green colour
2219/50139 . . . Calibration, setting tool after measurement on tool
2219/50141 . . . Setup tool, preset
2219/50142 . . . Measure parallelism of tool with respect to plane and correct
2219/50143 . . . Tool set up integrated, automatically transferred into control system
2219/50144 . . . Offline setup by simulation of process, during machining, forming of other piece
2219/50145 . . . Tool setup manual, preset of the machine
2219/50146 . . . Machine construction error compensation using ann
2219/50147 . . . Calibrate tool heads based on calibration of first tool head
2219/50148 . . . Workpiece, setup of component, workpiece
2219/50149 . . . Find orientation workpiece which maximizes number of faces machined in one setup
2219/50151 . . . Orient, translate, align workpiece to fit position assumed in program
2219/50152 . . . Align axis cylinder, tube with rotation axis machine
2219/50153 . . . Mount machining unit on workpiece, move unit on it
2219/50154 . . . Milling center
2219/50155 . . . Swivel spindle head horizontally
2219/50156 . . . Tiltable rotary table
2219/50157 . . . Universal swivel spindle head, swivel in all directions
2219/50158 . . . Modular structure
2219/50159 . . . Steady rest
2219/50161 . . . Reverse engineering, cloning
2219/50162 . . . Stewart platform, hexapod construction
2219/50163 . . . Machine stations and control modules build as a unity to be connected in line
2219/50164 . . . Select a structure to make programming of free curved surface easier
2219/50165 . . . Axis nc machine cooperates with two axis rotary table
2219/50166 . . . Extended range, machine a workpiece over a long distance
2219/50167 . . . Adapting to copying
2219/50168 . . . Retrofitting
2219/50169 . . . Double stewart platform
2219/50171 . . . Machine, machining centre, center
2219/50172 . . . Tool holder is transparent
2219/50173 . . . Machine tool hang and move on rail above workpiece
2219/50174 . . . Machine tool y-1, y-2, z, A-axis, table x, c-axis
2219/50175 . . . 6-Dof manipulator associated with 1-DOF workholder
2219/50176 . . . Table, general, for machine tool
2219/50177 . . . Protection for operator during operation, machining
2219/50178 . . . Clamp, brake gravity axis on power loss to clamp tool in position
2219/50179 . . . Dynamic tolerance, limit values as function of speed, type of command
2219/50181 . . . After stopping apply additionally a brake
2219/50182 . . . Skip over pieces between machining and measuring station, on tool changing
2219/50183 . . . Detect correct clamping of workpiece, chucks grip properly workpiece
2219/50184 . . . Stop feed if relative movement between drive and tool
2219/50185 . . . Monitoring, detect failures, control of efficiency of machine, tool life
2219/50186 . . . Diagnostic of spindle bearing
2219/50187 . . . Stop drive motor if clutch refuses, remains active, if emergency
2219/50188 . . . If operation, feed movement not done after maximum allowable time, emergency stop
2219/50189 . . . Compare position of slide with positioning, tape data
2219/50191 . . . Against noise
2219/50192 . . . If braking fails due to controller or amplifier fault, separate delayed braking
2219/50193 . . . Safety in general

2219/50194 . . . Before restarting machine, enter allowable, maximum speed corresponding to tool
2219/50195 . . . Emergency stop stops drives and spindle, stored program remains in memory
2219/50196 . . . Monitor clutch or belt drive
2219/50197 . . . Signature analysis, store working conditions, compare with actual
2219/50198 . . . Emergency stop
2219/50199 . . . Tool, nozzle is covered for protection in home position, if needed also heated
2219/50201 . . . Tool loses contact with workpiece, alarm if no cut through operation
2219/50202 . . . During movement of tool towards workpiece, shut down rotation, welding gun
2219/50203 . . . Tool, monitor condition tool
2219/50204 . . . Tool replacement point, tool change position without damage, clearance plane
2219/50205 . . . On tool breakage stop machine
2219/50206 . . . Tool monitoring integrated in nc control
2219/50207 . . . Surface finish
2219/50208 . . . Retrace, remachining part of path, locus to remove start discontinuities
2219/50209 . . . Surface treatment, roughing surface
2219/50211 . . . Finish machining, spark out, rough out
2219/50212 . . . Giving a texture, structure to surface, like leather, wood appearance
2219/50213 . . . Grooving of different forms or parallel to each other, grooving cycle
2219/50214 . . . Refurbish, refinish, reprofile, recondition, restore, rebuild profile
2219/50215 . . . Move synchronously tool and anvil at both sides of plate
2219/50216 . . . Synchronize speed and position of several axis, spindles
2219/50217 . . . Synchronize, control phase angle of two spindles by auxiliary index motor
2219/50218 . . . Synchronize groups of axis, spindles
2219/50219 . . . Slave spindle is driven at half the torque of main spindle for synchronism
2219/50221 . . . Switch speed reference from speed to position loop of both spindles to synchronize
2219/50222 . . . Stop machines, actuators until others reach common synchronization point
2219/50223 . . . Loose synchronisation, can shift within time interval
2219/50224 . . . Synchronize feed and spindle speed during slow down, stopping
2219/50225 . . . Synchronize feed and spindle speed as function of pitch of screw, thread
2219/50226 . . . Synchronize feed and spindle speed in forward and reverse feed
2219/50227 . . . Synchronize two axis by correcting for measured pitch errors
2219/50228 . . . Synchronize two slides, portal gantry, raising, moving
2219/50229 . . . Synchronize axis by simulating several virtual axis to control real axis
2219/50231 . . . Synchronize engage, disengage groups of axis as function of position of simulate
2219/50232 . . . Synchronize change of feed and spindle speed when overriding feed speed
2219/50233 . . . Synchronize time-dependent with electronic cam data
Synchronize two spindles, axis, electronic transmission, line shafting
Select tools, slides, spindles to work synchronized, independent
Tool editor for actual used tools and needed next, missing, unused tools
Detect wear by comparing coded value on tool with real value, grind tool
Search empty place in changer to place tool
Select tool manual from tool store, with permission from NC to deblock tool
Chuck, gripper, spindle changer
Tool changer and revolver fixed on spindle
Small buffer tool magazine, ordered tools, filled from large magazine, change time
Machine integrated tool cassette
Change tools, like laser head and drill having different driving needs
Workpiece exchange
Change to finer, more adapted tools to machine complex surface
Control position of coolant nozzle as function of selected tool
Tool, probe, pen changer
Mobile tool magazine to replace spare or rarely used tool
Replace, change tool with tracer head, probe, feeler
Selection tool
Change feeler or tool on different curvature of workpiece, model
Tool selection sets speed machining, kind of cooling, other parameter
Orienting selected tool with respect to workpiece
Kind of revolver magazine
Chain magazine
Flat bed magazine
Two tool holders to eliminate tool change time, replace and search simultaneously
Change tool at minimum distance from workpiece
Standby tool, tool ready for next machining step, change tool while machining
Change tool during positioning movement
If tool life over, continue machining only actual block, workability, then stop
During tool change, workpiece immobile, then execute backward operation sequence
Change tool and workpiece simultaneously, except if collision possible
Measure diameter only if new tool has been inserted
Minimize tool change by selecting appropriate fixture
Select second tool if first tool cannot machine workpiece without moving it
Change spare, used tool during machining, minimize machining time
Before motor start of spindle with new tool, detect if old tool back in storage
Measure new tool inserted by operator, compare with diameter needed to accept
Safety, verify correct code of chosen tool, probe
Detect wear or defect tool, breakage and change tool
Detection tool presence in tool holder, spindle before starting motor
Send offset values from tool changer before machining
Adjust displacement amount of tracer as function of rough, finish machining
Adjust tool for tool offset by using an axis parallel to feed axis
Tool offset as function of cutting depth
Tool offset for two different diameters, smoothing
Tool nose correction
Tool geometry compensation, keep contact of tool on desired curve
Fine adjustment tool head, adjustment with respect to toolholder
Tool offset as function of diameter of saw, for begin and end point of path
Compensate tool offset as function of speed, needed when tool is not mounted correctly in spindle
Tool offset general
Multi-tool, several tools
Tool offset based on two cutter contact points, admitting some overcut
Radial setting of tool
Tool offset length by going to a reference and recording distance
Tool offset by manual input by switches
Tool offset by verifying piece and registrating errors
Compensation of positioning error due to a-axis, b-axis tool rotation
Trace with feelers of different diameter, from the two loci calculate offset
Correction data stored in memory attached to tool or tool holder
Correction stored on tape, together with tool identification
Remachine same workpiece with same tool but diminished tool offset
Resolver
Correction from tape, file
For every diameter a tape
Tool height, axial displacement from center of circular workpiece, surface
Correction by probing dimension of machined workpiece
Estimate wear from machining data and conditions
Correction of wear as function of dressing
Compensate tool wear by grinding tool to a known position
Compensation of tool wear by adapting program to profile of tool
Tool offset, tool wear
Search for reference, go to reference
Selfcorrecting by measurement during machining
2219/50316 . . . Calculate as function of empirical calculated values from used tools
2219/50317 . . . As function of number of workpieces
2219/50318 . . . As function of number of cutting edges of saw, mill
2219/50319 . . . As function of tool geometry and machining data
2219/50321 . . . As function of machined volume per time unit
2219/50322 . . . As function of effective machining time
2219/50323 . . . As function of tool type
2219/50324 . . . As function of coolant
2219/50325 . . . As function of measured vibrations
2219/50326 . . . As function of feed forces
2219/50327 . . . As function of cutting forces
2219/50328 . . . As function of motor spindle load, current
2219/50329 . . . Tool offset for pockets, area machining avoiding interference with wall
2219/50331 . . . Electrode, wire gap compensation in edm, wire cutting
2219/50332 . . . Tool offset for 3-D surfaces normal to surface
2219/50333 . . . Tool offset for 2-D surfaces tangential to path or surface
2219/50334 . . . Tool offset, diameter correction
2219/50335 . . . Tool offset for straight lines
2219/50336 . . . Tool, probe offset for curves, surfaces, contouring
2219/50337 . . . Tool offset for point
2219/50338 . . . Tool with rom chip
2219/50339 . . . Select machining portion of tool according to surface of work
2219/50341 . . . Tool with right and left nose value, different radius
2219/50342 . . . Use two tools with different diameter
2219/50343 . . . Ball end tool, end is spherical
2219/50344 . . . Flat end tool, end is flat
2219/50345 . . . Bull nose tool, end is practical flat with rounded corners
2219/50346 . . . Ion ray
2219/50347 . . . Tool sends via electromagnetic waves actual working condition
2219/50348 . . . Deform tool to adapt to workpiece, bow tool with pressure
2219/50349 . . . Obtain normal vector of two points on surface, interpolate in between
2219/50351 . . . Rotate cutting tool to vary cutting tool geometry
2219/50352 . . . Inclination of tool as function of diameter of workpiece
2219/50353 . . . Tool, probe inclination, orientation to surface, posture, attitude
2219/50354 . . . If tool looses contact, change angle of tool with 90-degrees
2219/50355 . . . Tool perpendicular to a 2-D curve
2219/50356 . . . Tool perpendicular, normal to 3-D surface
2219/50357 . . . Tool tangential to path or surface
2219/50358 . . . Work handling, automatic load unload workpiece
2219/50359 . . . Rotate workpiece pallet, workpieces on it, machine and load simultaneously
2219/50361 . . . Translatory workpiece pallet, translate between two stations
2219/50362 . . . Load unload with robot
2219/50363 . . . Load unload with two robots, one to load, other to unload

2219/50364 . . . Buffer for workpieces, pallets, trays with articles
2219/50365 . . . Convey workpiece downwards on pallet, to machine rotate upwards
2219/50366 . . . Work handling with changeable hands
2219/50367 . . . Several workpiece holders in a single cell
2219/50368 . . . Pallet with autonomous control unit
2219/50369 . . . Display empty supply or discharge pallet
2219/50371 . . . Index table holds same number of load and unload cups, alternative
2219/50372 . . . Load pallets manually, with visual instruction assistance
2219/50373 . . . If pallet is not loaded conforming to instruction, warning
2219/50374 . . . Cylindrical workpiece holder, for each workpiece a separate tool slide
2219/50375 . . . Reject or reload workpiece if misaligned, excessive error in location
2219/50376 . . . Workholder receives also parts to be assembled with work
2219/50377 . . . Two robots with common workbase slides in union along pallets
2219/50378 . . . Control height gripper as function of thickness of workpiece and height of pallet
2219/50379 . . . Workpiece detector, sensor
2219/50381 . . . Load, unload workpiece while machining other one, dual table machine
2219/50382 . . . Position claws of first chuck relative to second chuck, to grip small workpiece
2219/50383 . . . Bar feeder applies torque to compensate bending of workpiece during machining
2219/50384 . . . Modular, exchangeable parts feeder
2219/50385 . . . Fast forward in idle time
2219/50386 . . . Feeder, feeding of workpiece, bar
2219/50387 . . . Two chucks, grippers, feeder bar, transfer workpiece from one to other
2219/50388 . . . Integrated loader, shuttle transfer
2219/50389 . . . Gantry loader
2219/50391 . . . Robot
2219/50392 . . . Overhead conveyor
2219/50393 . . . Floor conveyor, AGV automatic guided vehicle
2219/50394 . . . Bulk hopper
2219/50395 . . . Pallet magazines, transport dollies
2219/50396 . . . Gantry loader with two grippers, one always empty
2219/50397 . . . Two conveyors transporting together a workpiece to station
2219/50398 . . . For a single machine
2219/50399 . . . Between machines
2219/50401 . . . In line work storage system

Indexing scheme associated with group G05B 23/00

2223/00 Indexing scheme associated with group G05B 23/00
2223/02 . . . Indirect monitoring, e.g. monitoring production to detect faults of a system
2223/04 . . . Detection of intermittent failure
2223/06 . . . Remote monitoring