B60W COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING

TRANSPORTING

B60 VEHICLES IN GENERAL

B60W CONJOINT CONTROL OF VEHICLE SUB-UNITS OF DIFFERENT TYPE OR DIFFERENT FUNCTION; CONTROL SYSTEMS SPECIALLY ADAPTED FOR HYBRID VEHICLES; ROAD VEHICLE DRIVE CONTROL SYSTEMS FOR PURPOSES NOT RELATED TO THE CONTROL OF A PARTICULAR SUB-UNIT

NOTES

1. This subclass does not cover the control of a single sub-unit; such control is classified in the relevant place for the sub-unit, e.g. F02D, F16H. Where a single sub-unit is controlled by means of signals or commands from other sub-units, the control of this single sub-unit is classified in the relevant place for this sub-unit. For example, the control of variable-ratio gearing by means of signals from the engine or the accelerator is classified in the subclass for gearing, F16H.

2. Conjoint control of driveline units, e.g. engines, and variable-ratio gearing occurring only transiently during ratio shift and being also characterised by the control of the gearing is also classified in the subclass for gearing, F16H.

3. In groups B60W 20/00 - B60W 50/00, the first place priority rule is applied, i.e. at each hierarchical level, classification is made in the first appropriate place.

4. When classifying in group B60W 10/00, classification must also be made in groups B60W 20/00 - B60W 50/00 in order to identify the purpose or use of the control.

5. In this subclass, the following terms are used with the meanings indicated:
   • "conjoint control" means that a programmed or condition-responsive (main) automatic controller on board the vehicle, embodying control logic for vehicle sub-units of different type or different function, sends control signals to actuators of two or more vehicle sub-units, (three or more vehicle sub-units for groups B60W 30/00 - B60W 30/16), so that the sub-units act together to solve a particular problem or in response to a particular driving condition, (in order to improve stability, comfort or safety by managing the global dynamics of the vehicle);
   • "drive control system" means an electronic system in a road vehicle for automatically controlling the movement (by managing the global dynamics) of that vehicle in order to take certain actions (in order to improve stability, comfort or safety);
   • "road vehicle" means a (motorised passenger) vehicle normally under the control of a human driver for transportation on roads, e.g. an automobile, truck or bus;
   • "sub-unit" means one of the following vehicle systems: (driveline systems, e.g.) propulsion system, clutch system, change-speed gearing system, system for distributing drive torque between front and rear axles, axle differential system, brake system, steering system, suspension system, (and, particularly for hybrid vehicles,) energy storage means, fuel cells, or auxiliary equipment.

10/00 Conjoint control of vehicle sub-units of different type or different function (for propulsion of purely electrically-propelled vehicles with power supplied within the vehicle B60L 50/00)

NOTE

When classifying in this group, each controlled sub-unit must be separately identified by a classification in a relevant place in this group.

10/02 . . including control of driveline clutches
10/03 . . [Fluid clutches, e.g. torque converters]
10/06 . . (Clutches for bridging a fluid gearing, e.g. lock-up)
10/08 . . including control of propulsion units
10/09 . . including control of combustion engines
10/10 . . including control of electric propulsion units, e.g. motors or generators
10/11 . . including control of change-speed gearings
10/12 . . including control of differentials
10/13 . . with two input flow paths, e.g. double clutch transmission selection of one of the torque flow paths by the corresponding input clutch
10/14 . . with planetary gears
10/15 . . including control of all-wheel-driveline means, e.g. transfer gears or clutches for dividing torque between front and rear axle (B60W 10/14 takes precedence)
10/16 . . . . . . Infinitely variable gearings
10/17 . . . . . . of fluid type
10/18 . . . . . . of electric type
10/19 . . . . . . with endless flexible members
10/20 . . . . . . Friction gearings
10/21 . . . . . . of the toroid type
10/22 . . . . . . Stepped gearings
10/23 . . . . . . with separate change-speed gear trains arranged in series
10/24 . . . . . . . . . . with two input flow paths, e.g. double clutch transmission selection of one of the torque flow paths by the corresponding input clutch
10/25 . . . . . . . . with planetary gears
10/26 . . . . . . including control of all-wheel-driveline means, e.g. transfer gears or clutches for dividing torque between front and rear axle (B60W 10/14 takes precedence)

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20/00 Control systems specially adapted for hybrid vehicles (hybrid vehicle design, B60K 6/00; electric vehicles B60L)

20/10 Controlling the power contribution of each of the prime movers to meet required power demand

20/11 using model predictive control [MPC] strategies, i.e. control methods based on models predicting performance (utilising navigation and traffic information in the control strategy B60W 20/12)

20/12 using control strategies taking into account route information (estimation or calculation of non-directly measurable driving parameters B60W 40/00)

20/13 in order to stay within battery power input or output limits; in order to prevent overcharging or battery depletion

20/14 in conjunction with braking regeneration

20/15 Control strategies specially adapted for achieving a particular effect

20/16 for reducing engine exhaust emissions

20/17 for noise reduction

20/18 for avoiding ageing of fuel

20/19 for achieving enhanced acceleration

20/20 Control strategies involving selection of hybrid configuration, e.g. selection between series or parallel configuration

20/30 Control strategies involving selection of transmission gear ratio (control of change speed gearings, together with other vehicle sub-units B60W 10/10; HEV transmission gearing B60K 6/36; gearings and control thereof B164)

20/40 Controlling the engagement or disengagement of prime movers, e.g. for transition between prime movers (power-up or power-down of the driveline B60W 30/192)

20/50 Control strategies for responding to system failures, e.g. for fault diagnosis, fail-safe operation or limp mode

30/00 Purposes of road vehicle drive control systems not related to the control of a particular sub-unit, e.g. of systems using conjoint control of vehicle sub-units, or advanced driver assistance systems for ensuring comfort, stability and safety or drive control systems for propelling or retarding the vehicle (anti-lock brake systems [ABS] B60T 8/00)
30/181 . . . [Propulsion control with common controlling member for different functions]
30/189 . . . [Propulsion control with control means using analogue circuits, relays or mechanical links]
30/182 . . . Selecting between different operative modes, e.g. comfort and performance modes
30/184 . . . Preventing damage resulting from overload or excessive wear of the driveline
30/1843 . . . [Overheating of driveline components
(B60W 30/186 takes precedence)]
30/1846 . . . [Preventing of breakage of drive line components, e.g. parts of the gearing]
30/186 . . . excessive wear or burn out of friction elements, e.g. clutches
30/188 . . . Controlling power parameters of the driveline, e.g. determining the required power
30/1882 . . . [characterised by the working point of the engine, e.g. by using engine output chart]
30/1884 . . . [Avoiding stall or overspeed of the engine]
30/1886 . . . [Controlling power supply to auxiliary devices]
30/1888 . . . [Control of power take off [PTO]]
30/19 . . . Improvement of gear change, e.g. by synchronisation or smoothing gear shift
30/192 . . . Mitigating problems related to power-up or power-down of the driveline, e.g. start-up of a cold engine
30/194 . . . related to low temperature conditions, e.g. high viscosity of hydraulic fluid
30/20 . . . Reducing vibrations in the driveline
30/203 . . . [related or induced by the clutch]
30/206 . . . [related or induced by the engine]
40/00 Estimation or calculation of [non-directly measurable] driving parameters for road vehicle drive control systems not related to the control of a particular sub unit, [e.g. by using mathematical models]
40/02 . . . related to ambient conditions
40/04 . . . Traffic conditions
40/06 . . . Road conditions
40/064 . . . Degree of grip
40/068 . . . Road friction coefficient
40/072 . . . Curvature of the road
40/076 . . . Slope angle of the road
40/08 . . . related to drivers or passengers
2040/0809 . . . [Driver authorisation; Driver identical check]
2040/0818 . . . [Inactivity or incapacity of driver]
2040/0827 . . . [Due to sleepiness]
2040/0836 . . . [Due to alcohol]
2040/0845 . . . [Due to drugs]
2040/0854 . . . [Due to driver cheating, e.g. to circumvent driver tests]
2040/0863 . . . [Due to erroneous selection or response of the driver]
2040/0872 . . . [Driver physiology]
2040/0881 . . . [Seat occupation; Driver or passenger presence]
2040/089 . . . [Driver voice]
40/09 . . . Driving style or behaviour
40/10 . . . related to vehicle motion
40/1005 . . . [Driving resistance]
40/101 . . . Side slip angle of tyre
40/103 . . . Side slip angle of vehicle body
40/105 . . . Speed
40/107 . . . Longitudinal acceleration
40/109 . . . Lateral acceleration
40/11 . . . Pitch movement
40/112 . . . Roll movement
40/114 . . . Yaw movement
40/12 . . . related to parameters of the vehicle itself, [e.g. tyre models]
40/13 . . . Load or weight
2040/1307 . . . [Load distribution on each wheel suspension]
2040/1315 . . . [Location of the centre of gravity]
2040/1323 . . . [Moment of inertia of the vehicle body]
2040/133 . . . [About the roll axis]
2040/1338 . . . [About the pitch axis]
2040/1346 . . . [About the yaw axis]
2040/1353 . . . [Moment of inertia of a sub-unit]
2040/1361 . . . [The component being the engine]
2040/1369 . . . [The component being the clutch]
2040/1376 . . . [The component being the transmission]
2040/1384 . . . [The component being the wheel]
2040/1392 . . . [Natural frequency of components]
50/00 Details of control systems for road vehicle drive control not related to the control of a particular sub-unit, [e.g. process diagnostic or vehicle driver interfaces]
2050/0001 . . . [Details of the control system]
2050/0002 . . . [Automatic control, details of type of controller or control system architecture]
2050/0003 . . . [In analogue systems, e.g. continuous systems]
2050/0004 . . . [In digital systems, e.g. discrete-time systems involving sampling]
2050/0005 . . . [Processor details or data handling, e.g. memory registers or chip architecture]
2050/0006 . . . [Digital architecture hierarchy]
2050/0008 . . . [Feedback, closed loop systems or details of feedback error signal]
2050/0009 . . . [Proportional differential [PD] controller]
2050/001 . . . [Proportional integral [PI] controller]
2050/0011 . . . [Proportional Integral Differential [PID] controller]
2050/0012 . . . [Feedforward or open loop systems]
2050/0013 . . . [Optimal controllers]
2050/0014 . . . [Adaptive controllers]
2050/0016 . . . [State machine analysis]
2050/0017 . . . [Modal analysis, e.g. for determining system stability]
2050/0018 . . . [Method for the design of a control system]
2050/0019 . . . [Control system elements or transfer functions]
2050/002 . . . [Integrating means]
2050/0021 . . . [Differentiating means]
2050/0022 . . . [Gains, weighting coefficients or weighting functions]
2050/0024 . . . [Variable gains]
2050/0025 . . . [Transfer function weighting factor]
2050/0026 . . . [Lookup tables or parameter maps]
2050/0027 . . . [Minimum/maximum value selectors]
2050/0028 . . . [Mathematical models, e.g. for simulation]
2050/0029 . . . [Mathematical model of the driver]
2050/0031 . . . [Mathematical model of the vehicle]
2050/0032 . . . [Quarter vehicle model, i.e. only one vehicle corner]
Adapting control system settings

Automatic parameter input, automatic parameter estimation or state estimation

B60W

[Single-track, 2D vehicle model, i.e. two-wheel bicycle model]

[Multiple-track, 2D vehicle model, e.g. four-wheel model]

[Multiple-track, 3D vehicle model, e.g. including roll and pitch conditions]

[Multiple-track, 3D multi-body vehicle model, e.g. combination of models for vehicle sub-units]

[Mathematical models of vehicle sub-units]

(of the propulsion unit)

(of the clutch)

(of the drive line)

[Transfer function lag; delays]

[Signal treatments, identification of variables or parameters, parameter estimation or state estimation]

{ In digital systems}

{ using databus protocols}

{ Digital-analogue (D/A) or analogue-digital (A/D) conversion}

{ Addition or subtraction of signals}

{ Signal offset}

{ Sampling}

{ combined with averaging}

{ Filtering, filters}

{ Cut-off filters, retarders, delaying means, dead zones, threshold values or cut-off frequency}

{ High-pass filters}

{ Low-pass filters}

{ Frequency analysis, spectral techniques or transforms}

{ Signal modulation for data transmission}

{ Signal noise suppression}

{ Interpolation; Extrapolation}

{ Adapting control system settings]

{ Manual parameter input, manual setting means, manual initialising or calibrating means (for vehicle control input means, control panels see B60K 37/00)}

{ using a remote, e.g. cordless, transmitter or receiver unit, e.g. remote keypad or mobile phone}

{ using a personalised data carrier, e.g. magnetic card, memory card or electronic ignition key}

{ using buttons or a keyboard connected to the on-board processor}

{ Confirmation by the driver}

{ Giving intention of direction, e.g. by indicator lights, steering input]

{ Switching between manual and automatic parameter input, and vice versa]

{ Controller overrides driver automatically]

{ Controller asks driver to take over]

{ Driver overrides controller]

{ Driver shifts control to the controller, e.g. by pressing a button]

{ Automatic parameter input, automatic initialising or calibrating means]

{ involving external transmission of data to or from the vehicle]
2300/00  Indexing codes relating to the type of vehicle
2300/10  .  Buses
2300/105 .  Ambulances
2300/12  .  Trucks; Load vehicles
2300/121 .  Fork lift trucks, Clarks
2300/123 .  Light trucks
2300/125 .  Heavy duty trucks
2300/126 .  Multi-axles trucks
2300/128 .  Silo or fluid transporting vehicles
2300/13  .  Independent Multi-axle long vehicles
2300/135 .  Vehicles having wheels mounted on a vertical steerable column
2300/14  .  Trailers, e.g. full trailers, caravans (relation between towing and towed vehicle B60Y 2300/28)
2300/145 .  Semi-trailers
2300/15  .  Agricultural vehicles
2300/152 .  Tractors
2300/154 .  Boom carrying vehicles, e.g. for crop spraying
2300/156 .  Rideable lawn mowers
2300/158 .  Harvesters
2300/16  .  Cranes
2300/17  .  Construction vehicles, e.g. graders, excavators
2300/18  .  Four-wheel drive vehicles
2300/185 .  Off-road vehicles
2300/26  .  Military
2300/28  .  Racing vehicles, e.g. Formula one cars
2300/285 .  Go-karts
2300/30  .  Toys
2300/32  .  Amphibious vehicles
2300/34  .  Compact city vehicles
2300/345 .  Three wheelers not including single track vehicles
2300/36  .  Cycles; Motorcycles; Scooters
2300/362 .  Buggies; Quads
2300/365 .  Scooters
2300/367 .  Tricycles
2300/38  .  Wheelchairs; Perambulators
2300/40  .  Carts, e.g. trolleys
2300/405 .  Golf carts
2300/42  .  Loading ramps
2300/43  .  Snowmobile
2300/44  .  Tracked vehicles

2300/45  .  Skid-steer
2300/46  .  Variable track or wheelbase vehicles
2300/48  .  Low or lowerable bed vehicles
2300/50  .  Tilting frame vehicles

2400/00  Indexing codes relating to detected, measured or calculated conditions or factors
2420/00  Indexing codes relating to the type of sensors based on the principle of their operation
2422/00  Indexing codes relating to the special location or mounting of sensors
2424/00  Input parameters relating to a particular sub-units
2510/00  Indexing codes relating to detected, measured or calculated conditions or factors
2510/02  Clutches
2510/0208 .  Clutch engagement state, e.g. engaged or disengaged
2510/0209 .  Clutch slippage, i.e. difference between input and output speeds
2510/0216 .  Clutch engagement rate
2510/0225 .  Clutch actuator position
2510/0233 .  of torque converter lock-up clutch
2510/0241 .  Slip change rate
Input parameters relating to overall vehicle dynamics

- Position of fuel or air injector
- Air-fuel ratio
- Fuel flow rate
- Inlet air flow rate
- Turbocharger state
- Engine speed
- Idle condition
- Speed condition
- Coasting condition
- Torque change rate
- Engine torque
- Torque change rate
- Engine power
- Engine manifold pressure
- Engine temperature
- Engine exhaust temperature
- Engine crank angle
- Engine braking signal
- Electric propulsion units
- Speed
- Acceleration
- Speed change rate
- Torque
- Torque change rate
- Power
- Power change rate
- Temperature
- Inertia
- Other types of propulsion units, e.g. fluid motors, or type not specified
- Change speed gearings
- Transmission ratio engaged
- Transmission neutral state
- Input shaft speed, e.g. turbine speed
- Input speed change rate
- Input torque
- Input torque change rate
- Input power
- Output speed
- Output speed change rate
- Output torque
- Output torque change rate
- Output power
- Transmission of zero torque
- Temperature
- Fluid pressure, e.g. oil pressure
- Pressure of control fluid
- Pressure of working fluid
- Direction of power flow
- Inertia
- Differentials
- Locking status
- Braking system
- Brake pressure, e.g. of fluid or between pad and disc
- Brake temperature, e.g. of fluid, pads or discs
- Status of parking brakes
- Parking lock mechanisms
- Steering systems
- Steering torque
- Steering speed
- Oversteer or understeer
- Suspension systems
- Stiffness
- Damping
- Oscillation frequency
- Energy storage means
- for electrical energy
- Charge state
- Temperature
- Age of storage means
- Fuel cells
- Temperature
- Auxiliary equipments
- Power absorbed by auxiliaries

Input parameters relating to overall vehicle conditions or values

- Vehicle stop
- Direction of travel
- Longitudinal speed
- Longitudinal acceleration
- Lateral speed
- Lateral acceleration
- Yaw
- Pitch
- Roll
- Sideslip angle
- Articulation angle, e.g. between tractor and trailer
- Wheel slip
- Slip values between front and rear axle
- Slip values between left and right wheel
- Wheel speed
- Wheel torque
- Torque distribution
- between front and rear axle
- between left and right wheel

Input parameters relating to the driver

- Driver's voice
- Driver selection, e.g. driver confirmation
- Ignition switch
- Accelerator pedal position
- Accelerator thresholds, e.g. kickdown
- Rate of change
- Brake pedal position
- Clutch pedal position
- Ratio selector position
- Rate of change
- Steering angle
- Direction indicator values
- Psychological state; Stress level or workload
- Drug level, e.g. alcohol
- Incapacity of driver
Output or target parameters relating to a systems or control processes

Indexing codes relating to automatic control systems or control processes

Output or target parameters relating to overall vehicle dynamics
2720/103 . . Speed profile
2720/106 . . Longitudinal acceleration
2720/12 . . Lateral speed
2720/125 . . Lateral acceleration
2720/14 . . Yaw
2720/16 . . Pitch
2720/18 . . Roll
2720/20 . . Sideslip angle
2720/22 . . Articulation angle, e.g. between tractor and trailer
2720/24 . . Direction of travel
2720/26 . . Wheel slip
2720/263 . . Slip values between front and rear axle
2720/266 . . Slip values between left and right wheel
2720/28 . . Wheel speed
2720/30 . . Wheel torque
2720/40 . . Torque distribution
2720/403 . . between front and rear axle
2720/406 . . between left and right wheel

2750/00 Output or target parameters relating to exterior, e.g. between vehicles
2750/30 . . Distance or speed in relation to other vehicles
2750/302 . . the longitudinal speed of preceding vehicle
2750/304 . . the lateral speed of preceding vehicle
2750/306 . . the position of preceding vehicle
2750/308 . . the distance between vehicles
2750/40 . . Involving external transmission of data to or from the vehicle

2900/00 Indexing codes relating to the purpose of, or problem solved of road vehicle drive control systems not otherwise provided for in groups B60W 30/00