CPC 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, 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
10/023 [Fluid clutches, e.g. torque converters]
10/026 [Clutches for bridging a fluid gearing, e.g. lock-up]
10/04 including control of propulsion units
10/06 including control of combustion engines
10/08 including control of electric propulsion units, e.g. motors or generators
10/10 including control of change-speed gearings
10/101 . . . Infinitely variable gearings
10/103 . . . of fluid type
10/105 . . . of electric type
10/107 . . . with endless flexible members
10/108 . . . Friction gearings
10/109 . . . of the toroid type
10/11 . . . Stepped gearings
10/111 . . . with separate change-speed gear trains arranged in series
10/113 . . . with two input flow paths, e.g. double clutch transmission selection of one of the torque flow paths by the corresponding input clutch
10/115 . . . with planetary gears
10/119 . . . 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)
10/12 . . . including control of differentials
Central differentials for dividing torque between front and rear axles
Axle differentials, e.g. for dividing torque between left and right wheels
including control of braking systems
(including control of parking brakes)
with wheel brakes
hydraulic brakes
electric brakes
acting within the driveline, e.g. retarders
with exhaust brakes
including control of steering systems
including control of suspension systems
including control of energy storage means
for electrical energy, e.g. batteries or capacitors
including control of fuel cells
including control of auxiliary equipment, e.g. air-conditioning compressors or oil pumps

Control systems specially adapted for hybrid vehicles (hybrid vehicle design, B60K 6/00; electric vehicles B60L)
Controlling the power contribution of each of the prime movers to meet required power demand
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])
using control strategies taking into account route information ([estimation or calculation of non-directly measurable driving parameters B60W 40/00])
in order to stay within battery power input or output limits; in order to prevent overcharging or battery depletion
in conjunction with braking regeneration
Control strategies specially adapted for achieving a particular effect
for reducing engine exhaust emissions
for noise reduction
for avoiding ageing of fuel
for achieving enhanced acceleration
Control strategies involving selection of hybrid configuration, e.g. selection between series or parallel configuration
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 E164])
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])
Control strategies for responding to system failures, e.g. for fault diagnosis, fail-safe operation or limp mode

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)

Control of vehicle driving stability
[related to comfort of drivers or passengers]
related to roll-over prevention
[about the pitch axis]
[about the roll axis]
Improving turning performance
Automatic manoeuvring for parking (controlling only the steering B62D 15/0285)
[Active safety systems] predicting or avoiding probable or impending collision [or attempting to minimise its consequences]
[Vehicle operation after collision]
Taking automatic action to adjust vehicle attitude in preparation for collision, e.g. braking for nose dropping
Taking automatic action to avoid collision, e.g. braking and steering
Predicting travel path or likelihood of collision
[the prediction being responsive to vehicle dynamic parameters]
[the prediction being responsive to traffic or environmental parameters]
Path keeping ([cruise control for automatically following a preceding vehicle B60W 30/165])
Lane keeping
{Adaptive} cruise control
{Speed control (B60W 30/16 takes precedence)}
{Speed limiting}
Control of distance between vehicles, e.g. keeping a distance to preceding vehicle
{Speed limiting therefor}
Automatically following the path of a preceding lead vehicle, e.g. "electronic tow-bar"
with provision for special action when the preceding vehicle comes to a halt, e.g. stop and go
Propelling the vehicle
[related to particular drive situations]
[Start-stop drive, e.g. in a traffic jam]
[Drive off, accelerating from standstill]
{Reversing}
{Rocking, i.e. fast change between forward and reverse}
{at stand still, e.g. engine in idling state (hill holding B60W 30/18118)}
{Creeping}
{Coasting}
{With torque flow from driveshaft to engine, i.e. engine being driven by vehicle}
{Without torque flow between driveshaft and engine, e.g. with clutch disengaged or transmission in neutral}
[Preparing for stopping]
{Braking}
{Hill holding}
{Regenerative braking}
{Engine braking}
{Cornering}
{Approaching an intersection}
{Lane change; Overtaking manoeuvres}
{Preventing, or responsive to skidding of wheels}
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

- Details of the control system
- Automatic control, details of type of controller or control system architecture
- In analogue systems, e.g. continuous systems
- In digital systems, e.g. discrete-time systems involving sampling
- Processor details or data handling, e.g. memory registers or chip architecture
- Digital architecture hierarchy
- Feedback, closed loop systems or details of feedback error signal

- Proportional differential [PD] controller
- Proportional integral [PI] controller
- Proportional Integral Differential [PID] controller
- Feedforward or open loop systems
- Optimal controllers
- Adaptive controllers
- State machine analysis
- Modal analysis, e.g. for determining system stability
- Method for the design of a control system
- Control system elements or transfer functions
- Integrating means
- Differentiating means
- Gains, weighting coefficients or weighting functions
- Variable gains
- Transfer function weighting factor
- Lookup tables or parameter maps
- Minimum/maximum value selectors
- Mathematical models, e.g. for simulation
- Mathematical model of the driver
- Mathematical model of the vehicle
- Quarter vehicle model, i.e. only one vehicle corner
[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]
Indexing codes relating to the type of vehicle

- Buses
- Ambulances
- Trucks; Load vehicles
- Fork lift trucks, Clarks
- Light trucks
- Heavy duty trucks
- Multi-axles trucks
- Silo or fluid transporting vehicles
- Independent Multi-axle long vehicles
- Vehicles having wheels mounted on a vertical steerable column
- Trailers, e.g. full trailers, caravans (relation between towing and towed vehicle B60Y 2300/28)
- Semi-trailers
- Agricultural vehicles
- Tractors
- Boom carrying vehicles, e.g. for crop spraying
- Ridable lawn mowers
- Harvester
- Cranes
- Construction vehicles, e.g. graders, excavators
- Four-wheel drive vehicles
- Off-road vehicles
- Military
- Racing vehicles, e.g. Formula one cars
- Go-karts
- Toys
- Amphibious vehicles
- Compact city vehicles
- Three wheelers not including single track vehicles
- Cycles; Motorcycle; Scooters
- Buggies; Quads
- Scooters
- Tricycles
- Wheelchairs; Perambulators
- Carts, e.g. trolleys
- Golf carts
- Loading ramps
- Snowmobile
- Tracked vehicles

Indexing codes relating to detected, measured or calculated conditions or factors

- Skid-steer
- Variable track or wheelbase vehicles
- Low or lowerable bed vehicles
- Tilting frame vehicles

Indexing codes relating to the special location or mounting of sensors

- on a suspension arm
- on or inside a spring
- the spring being a coil spring
- the spring being a pneumatic spring
- the spring being a leaf spring
- on a damper
- on a steering column
- on the wheel or the tire
- on wheel hub bearing
- on bumper, e.g. collision sensor
- Measuring the same parameter at multiple locations of the vehicle

Input parameters relating to a particular sub-units

- Clutches
- Clutch engagement state, e.g. engaged or disengaged
- Clutch engagement rate
- Clutch actuator position
- of torque converter lock-up clutch
- Clutch slip, i.e. difference between input and output speeds
- Slip change rate
- Clutch friction coefficient
- Moment of inertia
- Clutch torque
- Clutch input shaft speed
- Clutch temperature
- Combustion engines, Gas turbines
- Throttle position
- Throttle change rate
### Input parameters relating to overall vehicle dynamics

- **2520/00**
  - 2520/04: Vehicle stop
  - 2520/06: Direction of travel
  - 2520/10: Longitudinal speed
  - 2520/12: Lateral speed
  - 2520/14: Yaw
  - 2520/16: Pitch
  - 2520/18: Roll
  - 2520/20: Sideslip angle
  - 2520/22: Articulation angle, e.g. between tractor and trailer
  - 2520/26: Wheel slip
  - 2520/263: Slip values between front and rear axle
  - 2520/266: Slip values between left and right wheel
  - 2520/28: Wheel speed
  - 2520/30: Wheel torque
  - 2520/40: Torque distribution
  - 2520/403: between front and rear axle
  - 2520/406: between left and right wheel

### Input parameters relating to other vehicle conditions or values

- **2530/00**
  - 2530/10: Weight
  - 2530/12: Catalyst or filter state
  - 2530/14: Historical data
  - 2530/145: Mileage
  - 2530/16: Driving resistance
  - 2530/18: Distance travelled
  - 2530/20: Tyre data
  - 2530/22: Towing force

### Input parameters relating to the driver

- **2540/00**
  - 2540/02: Driver's voice
  - 2540/04: Driver selection, e.g. driver confirmation
  - 2540/06: Ignition switch
  - 2540/10: Accelerator pedal position
  - 2540/103: Accelerator thresholds, e.g. kickdown
  - 2540/106: Rate of change
  - 2540/12: Brake pedal position
  - 2540/14: Clutch pedal position
  - 2540/16: Ratio selector position
  - 2540/165: Rate of change
  - 2540/18: Steering angle
  - 2540/20: Direction indicator values
  - 2540/22: Psychological state; Stress level or workload
  - 2540/24: Drug level, e.g. alcohol
  - 2540/26: Incapacity of driver
2540/28  . Identity of driver
2540/30  . Driving style

2550/00   Input parameters relating to exterior conditions
2550/10  . from obstacle detection
2550/12  . Ambient conditions, e.g. wind or rain
2550/13  . Altitude
2550/14  . Road conditions, road types or road features
2550/141  . Type of road
2550/142  . Road slope
2550/143  . Road profile
2550/145  . Road altitude
2550/146  . Road curve radius
2550/147  . Road bumpiness, e.g. pavement or potholes
2550/148  . Coefficient of friction
2550/16  . Country codes
2550/20  . Traffic related input parameters
2550/22  . Traffic rules, e.g. traffic signs
2550/30  . Distance or speed relative to other vehicles
2550/302  . the longitudinal speed of preceding vehicle
2550/304  . the lateral speed of preceding vehicle
2550/306  . the position of preceding vehicle
2550/308  . Distance between vehicles
2550/40  . Involving external transmission of data to or from the vehicle
2550/402  . for navigation systems
2550/404  . using telemetry
2550/406  . using satellite communication
2550/408  . Data transmitted between vehicles

2560/00  Other vehicle related input parameters not covered by groups B60W 2510/00 - B60W 2550/00
2560/02  . Remaining fuel quantity in tank
2560/04  . Fuel quality, e.g. water content due to age of fuel
2560/06  . Fuel type

2600/00   Indexing codes relating to automatic control systems or control processes

2710/00  Output or target parameters relating to a particular sub-units

2710/02  . Clutches
2710/021  . Clutch engagement state
2710/022  . Clutch actuator position
2710/023  . Clutch engagement rate
2710/024  . of torque converter lock-up clutch
2710/025  . Clutch slip, i.e. difference between input and output speeds
2710/026  . Slip change rate
2710/027  . Clutch torque
2710/028  . Clutch input shaft speed
2710/029  . Clutch temperature
2710/06  . Combustion engines, Gas turbines
2710/0605  . Throttle position
2710/0611  . Throttle change rate
2710/0616  . Position of fuel or air injector
2710/0622  . Air-fuel ratio
2710/0627  . Fuel flow rate
2710/0633  . Inlet air flow rate
2710/0638  . Turbocharger state
2710/0644  . Engine speed
2710/065  . Idle condition
2710/0655  . Coasting condition
2710/0661  . Speed change rate

2710/0666  . Engine torque
2710/0672  . Torque change rate
2710/0677  . Engine power
2710/0683  . Engine manifold pressure
2710/0688  . Engine temperature
2710/0694  . Engine exhaust temperature
2710/08  . Electric propulsion units
2710/081  . Speed
2710/082  . Speed change rate
2710/083  . Torque
2710/085  . Torque change rate
2710/086  . Power
2710/087  . Power change rate
2710/088  . Temperature
2710/09  . Other types of propulsion units, e.g. fluid motors, or type not specified
2710/10  . Change speed gearings
2710/1005  . Transmission ratio engaged
2710/1011  . Input shaft speed, e.g. turbine speed
2710/1016  . Input speed change rate
2710/1022  . Input torque
2710/1027  . Input torque change rate
2710/1033  . Input power
2710/1038  . Output speed
2710/1044  . Output speed change rate
2710/105  . Output torque
2710/1055  . Output torque change rate
2710/1061  . Output power
2710/1066  . Transmission of zero torque
2710/1072  . Temperature
2710/1077  . fluid pressure, e.g. oil pressure
2710/1083  . pressure of control fluid
2710/1088  . pressure of working fluid
2710/1094  . Direction of power flow
2710/12  . Differentials
2710/125  . Locking status
2710/18  . Braking system
2710/182  . Brake pressure, e.g. of fluid or between pad and disc
2710/184  . Brake temperature, e.g. of fluid, pads or discs
2710/186  . Status of parking brakes
2710/188  . Parking lock mechanisms
2710/20  . Steering systems
2710/202  . Steering torque
2710/205  . Steering speed
2710/207  . Steering angle of wheels
2710/22  . Suspension systems
2710/223  . Stiffness
2710/226  . Damping
2710/24  . Energy storage means
2710/242  . for electrical energy
2710/244  . Charge state
2710/246  . Temperature
2710/248  . Current for loading or unloading
2710/28  . Fuel cells
2710/285  . Temperature
2710/30  . Auxiliary equipments
2710/305  . target power to auxiliaries

2720/00   Output or target parameters relating to overall vehicle dynamics
2720/10  . Longitudinal speed
B60W

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