CPC COOPERATIVE PATENT CLASSIFICATION

H ELECTRICITY

(NOTE omitted)

H02 GENERATION; CONVERSION OR DISTRIBUTION OF ELECTRIC POWER

H02P CONTROL OR REGULATION OF ELECTRIC MOTORS, ELECTRIC GENERATORS OR DYNAMO-ELECTRIC CONVERTERS; CONTROLLING TRANSFORMERS, REACTORS OR CHOKE COILS

NOTES

1. This subclass covers arrangements for starting, regulating, electronically commutating, braking, or otherwise controlling motors, generators, dynamo-electric converters, clutches, brakes, gears, transformers, reactors or choke coils, of the types classified in the relevant subclasses, e.g. H01F, H02K.
2. This subclass does not cover similar arrangements for the apparatus of the types classified in subclass H02N, which arrangements are covered by that subclass.
3. In this subclass, it is desirable to add the indexing codes of groups H02P 2101/00 and H02P 2103/00

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 **Arrangements for starting electric motors or dynamo-electric converters** (starting of synchronous motors with electronic commutators H02P 6/20, H02P 6/22; starting dynamo-electric motors rotating step by step H02P 8/04; vector control H02P 21/00)

NOTE

{Group H02P 1/029 takes precedence over groups H02P 1/26 - H02P 1/54.}

1/02 . Details {of starting control}
1/021 . . {Protection against "no voltage condition"}
1/022 . . {Security devices, e.g. correct phase sequencing}
1/023 . . . {Protection against sparking of contacts or sticking together}
1/024 . . . {Protection against simultaneous starting by two starting devices}
1/025 . . . {Protection against starting if starting resistor is not at zero position}
1/026 . . . {Means for delayed starting}
1/027 . . {Special design of starting resistor}
1/028 . . {wherein the motor voltage is increased at low speed, to start or restart high inertia loads}
1/029 . . {Restarting, e.g. after power failure}
1/04 . . Means for controlling progress of starting sequence in dependence upon time or upon current, speed, or other motor parameter
1/06 . . . Manually-operated multi-position starters
1/08 . . . Manually-operated on/off switch controlling power-operated multi-position switch or impedances for starting a motor
1/10 . . . Manually-operated on/off switch controlling relays or contactors operating sequentially for starting a motor
1/12 . . . Switching devices centrifugally operated by the motor
1/14 . . . Pressure-sensitive resistors centrifugally operated by the motor
1/16 . for starting dynamo-electric motors or dynamo-electric converters
1/163 . . {for starting an individual reluctance motor}
1/166 . . {Driving load with high inertia}
1/18 . . for starting an individual dc motor
1/20 . . . by progressive reduction of resistance in series with armature winding
1/22 . . . in either direction of rotation
1/24 . . for starting an individual ac commutator motor (starting of ac/dc commutator motors H02P 1/18)
1/26 . . for starting an individual polyphase induction motor
1/265 . . . {Means for starting or running a triphase motor on a single phase supply}
1/28 . . . by progressive increase of voltage applied to primary circuit of motor
1/30 . . . by progressive increase of frequency of supply to primary circuit of motor
1/32 . . . by star/delta switching
1/34 . . . by progressive reduction of impedance in secondary circuit
1/36 . . . . the impedance being a liquid resistance
1/38 . . . by pole-changing
1/40 . . . in either direction of rotation
1/42 . . for starting an individual single-phase induction motor {(H02P 27/04 takes precedence)}
1/423 . . . {by using means to limit the current in the main winding}
1/426 . . . {by using a specially adapted frequency converter}
1/44 . . . by phase-splitting with a capacitor
1/445 . . . . {by using additional capacitors switched at start up}
1/46 . . for starting an individual synchronous motor {(H02P 27/04 takes precedence)}
1/465 . . . {for starting an individual single-phase synchronous motor}

1/48 . . . by pole-changing
1/50 . . . by changing over from asynchronous to synchronous operation (H02P 1/48 takes precedence)
1/52 . . . by progressive increase of frequency of supply to motor
1/54 . . for starting two or more dynamo-electric motors
1/56 . . . simultaneously
1/58 . . . sequentially

3/00 Arrangements for stopping or slowing electric motors, generators, or dynamo-electric converters (stopping of synchronous motors with electronic commutators H02P 6/24; stopping dynamo-electric motors rotating step by step H02P 8/24; vector control H02P 21/00)
3/02 . Details {of stopping control}
3/025 . . {holding the rotor in a fixed position after deceleration}
3/04 . . Means for stopping or slowing by a separate brake, e.g. friction brake or eddy-current brake
3/06 . for stopping or slowing an individual dynamo-electric motor or dynamo-electric converter
3/065 . . {for stopping or slowing a reluctance motor}
3/08 . . for stopping or slowing a dc motor
3/10 . . . by reversal of supply connections
3/12 . . . by short-circuit or resistive braking
3/14 . . . by regenerative braking
3/16 . . . by combined electrical and mechanical braking
3/18 . . for stopping or slowing an ac motor
3/20 . . . by reversal of phase sequence of connections to the motor
3/22 . . . by short-circuit or resistive braking
3/24 . . . by applying dc to the motor
3/26 . . . by combined electrical and mechanical braking

4/00 Arrangements specially adapted for regulating or controlling the speed or torque of electric motors that can be connected to two or more different electric power supplies (vector control H02P 21/00)

5/00 Arrangements specially adapted for regulating or controlling the speed or torque of two or more electric motors (H02P 6/04, H02P 8/40 take precedence)
5/46 . for speed regulation of two or more dynamo-electric motors in relation to one another
5/48 . . by comparing mechanical values representing the speeds
5/485 . . . using differential movement of the two motors, e.g. using differential gearboxes
5/49 . . . by intermittently closing or opening electrical contacts
5/50 . . by comparing electrical values representing the speeds
5/505 . . . using equalising lines, e.g. rotor and stator lines of first and second motors
5/51 . . . Direct ratio control
5/52 . . additionally providing control of relative angular displacement
5/54 . . . Speed and position comparison between the motors by mechanical means
5/56 . . . Speed and position comparison between the motors by electrical means
5/60 . controlling combinations of dc and ac dynamo-electric motors (H02P 5/46 takes precedence)
5/68 . controlling two or more dc dynamo-electric motors (H02P 5/46, H02P 5/60 take precedence)
5/685 . . electrically connected in series, i.e. carrying the same current
5/69 . . mechanically coupled by gearing
5/695 . . . Differential gearing
5/74 . controlling two or more ac dynamo-electric motors (H02P 5/46, H02P 5/60 take precedence)
5/747 . . mechanically coupled by gearing
5/753 . . . Differential gearing

6/00 Arrangements for controlling synchronous motors or other dynamo-electric motors using electronic commutation dependent on the rotor position; Electronic commutators therefor (vector control H02P 21/00)

NOTE

Group H02P 6/26 takes precedence over groups H02P 6/04–H02P 6/24 and H02P 6/28 – H02P 6/34

6/005 . {Arrangements for controlling doubly fed motors}
6/006 . {Controlling linear motors}
6/007 . {wherein the position is detected using the ripple of the current caused by the commutation}
6/04 . Arrangements for controlling or regulating the speed or torque of more than one motor (H02P 6/10 takes precedence)
2006/045 . . {Control of current}
6/06 . Arrangements for speed regulation of a single motor wherein the motor speed is measured and compared with a given physical value so as to adjust the motor speed
6/08 . Arrangements for controlling the speed or torque of a single motor (H02P 6/10, H02P 6/28 take precedence)
6/085 . . {in a bridge configuration}
6/10 . Arrangements for controlling torque ripple, e.g. providing reduced torque ripple
6/12 . Monitoring commutation; Providing indication of commutation failure
6/14 . Electronic commutators
6/15 . . Controlling commutation time
6/153 . . . {wherein the commutation is advanced from position signals phase in function of the speed}
6/157 . . . {wherein the commutation is function of electro-magnetic force [EMF]}
6/16 . . Circuit arrangements for detecting position
6/17 . . . and for generating speed information
6/18 . . . without separate position detecting elements
6/181 . . . . {using different methods depending on the speed}
6/182 . . . . using back-emf in windings
6/183 . . . . {using an injected high frequency signal}
6/185 . . . . using inductance sensing, e.g. pulse excitation
6/186 . . . . {using difference of inductance or reluctance between the phases}
6/187 . . . . {using the star point voltage}
6/188 . . . . {using the voltage difference between the windings (H02P 6/182 takes precedence)}

6/20 . Arrangements for starting (H02P 6/08 takes precedence)
6/21 . . Open loop start
6/22 . . in a selected direction of rotation
6/24 . Arrangements for stopping
6/26 . Arrangements for controlling single phase motors
6/28 . Arrangements for controlling current (H02P 6/10 takes precedence)
6/30 . Arrangements for controlling the direction of rotation (H02P 6/22 takes precedence)
6/32 . Arrangements for controlling wound field motors, e.g. motors with exciter coils
6/34 . Modelling or simulation for control purposes

7/00 Arrangements for regulating or controlling the speed or torque of electric DC motors

7/0094 . {wherein the position is detected using the ripple of the current caused by the commutator}
7/02 . the DC motors being of the linear type
7/025 . . the DC motors being of the moving coil type, e.g. voice coil motors
7/03 . for controlling the direction of rotation of DC motors
7/04 . . {by means of a H-bridge circuit}
7/05 . . {by means of electronic switching}
7/06 . for regulating or controlling an individual dc dynamo-electric motor by varying field or armature current
7/063 . . {using centrifugal devices, e.g. switch, resistor}
7/066 . . {using a periodic interrupter, e.g. Tirrill regulator}
7/08 . . by manual control without auxiliary power
7/10 . . . of motor field only
7/12 . . . . Switching field from series to shunt excitation or vice versa
7/14 . . . of voltage applied to the armature with or without control of field
7/18 . . by master control with auxiliary power
7/20 . . . using multi-position switch, e.g. drum, controlling motor circuit by means of relays (H02P 7/24, H02P 7/30 take precedence)
7/22 . . . using multi-position switch, e.g. drum, controlling motor circuit by means of pilot-motor-operated multi-position switch or pilot-motor-operated variable resistance (H02P 7/24, H02P 7/30 take precedence)
7/24 . . . using discharge tubes or semiconductor devices
7/245 . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/26 . . . . using discharge tubes
7/265 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/28 . . . . using semiconductor devices
7/2805 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/281 . . . . . the DC motor being operated in four quadrants

NOTE

Group H02P 7/281 takes precedence over groups H02P 7/282 – H02P 7/298.

7/2815 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/282 . . . . . controlling field supply only
7/2825 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/285 . . . . . controlling armature supply only
7/2855 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/288 . . . . . using variable impedance
7/2885 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/29 . . . . . using pulse modulation
7/291 . . . . . with on-off control between two set points, e.g. controlling by hysteresis
7/2913 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/292 . . . . . using static converters, e.g. AC to DC
7/293 . . . . . using phase control (H02P 7/295 takes precedence)
7/295 . . . . . of the kind having one thyristor or the like in series with the power supply and the motor
7/298 . . . . . controlling armature and field supplies
7/2985 . . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/30 . . . using magnetic devices with controllable degree of saturation, i.e. transductors
7/305 . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/32 . . . using armature-reaction-excited machines, e.g. metadyne, amplidyne, rototrol
7/325 . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
7/34 . . . using Ward-Leonard arrangements
7/343 . . . . in which both generator and motor fields are controlled
7/347 . . . . in which only the generator field is controlled
7/348 . . . {for changing between series and parallel connections of motors}

8/00 Arrangements for controlling dynamo-electric motors rotating step by step

8/005 . {of linear motors}
8/02 . specially adapted for single-phase or bi-pole stepper motors, e.g. watch-motors, clock-motors

NOTE

{Groups H02P 8/005 and H02P 8/02 take precedence over groups H02P 8/04 - H02P 8/42}

8/04 . Arrangements for starting
8/06 . . in selected direction of rotation
8/08 . . Determining position before starting
8/10 . . Shaping pulses for starting; Boosting current during starting
8/12 . Control or stabilisation of current
8/14 . Arrangements for controlling speed or speed and torque (H02P 8/12, H02P 8/22 take precedence)
8/16 . . Reducing energy dissipated or supplied
8/165 . . . {using two level supply voltage}
8/18 . . Shaping of pulses, e.g. to reduce torque ripple {(Reducing overshoot H02P 8/32 takes precedence)}
8/20 . . characterised by bidirectional operation
8/22 . Control of step size; Intermediate stepping, e.g. microstepping
8/24 . Arrangements for stopping (H02P 8/32 takes precedence)
8/26 . . Memorising final pulse when stopping
8/28 . . Disconnecting power source when stopping
8/30 . . Holding position when stopped
8/32 . Reducing overshoot or oscillation, e.g. damping
8/34 . Monitoring operation (H02P 8/36 takes precedence)
8/36 . Protection against faults, e.g. against overheating or step-out; Indicating faults
8/38 . . the fault being step-out
8/40 . Special adaptations for controlling two or more stepping motors
8/42 . characterised by non-stepper motors being operated step by step

9/00 Arrangements for controlling electric generators for the purpose of obtaining a desired output

9/006 . {Means for protecting the generator by using control (control effected upon generator excitation circuit to reduce harmful effects of overloads or transients H02P 9/10)}
9/007 . {Control circuits for doubly fed generators}
9/008 . {wherein the generator is controlled by the requirements of the prime mover}
9/009 . {Circuit arrangements for detecting rotor position}
9/02 . Details {of the control}
9/04 . Control effected upon non-electric prime mover and dependent upon electric output value of the generator
9/06 . Control effected upon clutch or other mechanical power transmission means and dependent upon electric output value of the generator
9/08 . Control of generator circuit during starting or stopping of driving means, e.g. for initiating excitation
9/10 . Control effected upon generator excitation circuit to reduce harmful effects of overloads or transients, e.g. sudden application of load, sudden removal of load, sudden change of load
9/102 . . {for limiting effects of transients}
9/105 . . {for increasing the stability}
9/107 . . {for limiting effects of overloads}
9/12 . . for demagnetising; for reducing effects of remanence; for preventing pole reversal
9/123 . . . {for demagnetising; for reducing effects of remanence}
9/126 . . . {for preventing pole reversal}
9/14 . by variation of field (H02P 9/08, H02P 9/10 take precedence)
9/16 . . due to variation of ohmic resistance in field circuit, using resistances switched in or out of circuit step by step
9/18 . . . the switching being caused by a servomotor, measuring instrument, or relay
9/20 . . due to variation of continuously-variable ohmic resistance
9/22 . . . comprising carbon pile resistance
9/24 . . due to variation of make-to-break ratio of intermittently-operating contacts, e.g. using Tirrill regulator
9/26 . . using discharge tubes or semiconductor devices (H02P 9/34 takes precedence)
9/28 . . . using discharge tubes
9/30 . . . using semiconductor devices
9/302 . . . . {Brushless excitation}
9/305 . . . . {controlling voltage (H02P 9/302 takes precedence)}
9/307 . . . . . {more than one voltage output}
9/32 . . using magnetic devices with controllable degree of saturation (H02P 9/34 takes precedence)
9/34 . . using magnetic devices with controllable degree of saturation in combination with controlled discharge tube or controlled semiconductor device
9/36 . . using armature-reaction-excited machines
9/38 . . Self-excitation by current derived from rectification of both output voltage and output current of generator
9/40 . by variation of reluctance of magnetic circuit of generator
9/42 . to obtain desired frequency without varying speed of the generator
9/44 . Control of frequency and voltage in predetermined relation, e.g. constant ratio
9/46 . Control of asynchronous generator by variation of capacitor
9/48 . Arrangements for obtaining a constant output value at varying speed of the generator, e.g. on vehicle (H02P 9/04 - H02P 9/46 take precedence)

11/00 Arrangements for controlling dynamo-electric converters

11/04 . for controlling dynamo-electric converters having a dc output
11/06 . for controlling dynamo-electric converters having an ac output

13/00 Arrangements for controlling transformers, reactors or choke coils, for the purpose of obtaining a desired output

13/06 . by tap-changing; by rearranging interconnections of windings
13/08 . by sliding current collector along winding
13/10 . by moving core, coil winding, or shield, e.g. by induction regulator
13/12 . by varying magnetic bias

15/00 Arrangements for controlling dynamo-electric brakes or clutches (vector control H02P 21/00)

15/02 . Conjoint control of brakes and clutches

17/00 **Arrangements for controlling dynamo-electric gears** (vector control H02P 21/00)

21/00 **Arrangements or methods for the control of electric machines by vector control, e.g. by control of field orientation**

NOTES

1. When classifying in this group, classification should also be made in group H02P 25/00 when the method of control is characterised by the kind of motor being controlled.
2. When classifying in this group, classification should also be made in group H02P 27/00 when the method of control is characterised by the kind of supply voltage of the motor being controlled.

21/0003 . {Control strategies in general, e.g. linear type, e.g. P, PI, PID, using robust control}
21/0007 . . {using sliding mode control}
21/001 . . {using fuzzy control}
21/0014 . . {using neural networks}
21/0017 . . {Model reference adaptation, e.g. MRAS or MRAC, useful for control or parameter estimation}
21/0021 . . {using different modes of control depending on a parameter, e.g. the speed}
21/0025 . . {implementing a off line learning phase to determine and store useful data for on-line control}
21/0085 . {specially adapted for high speeds, e.g. above nominal speed}
21/0089 . . {using field weakening}
21/02 . specially adapted for optimising the efficiency at low load
21/04 . specially adapted for very low speeds
21/05 . specially adapted for damping motor oscillations, e.g. for reducing hunting
21/06 . Rotor flux based control involving the use of rotor position or rotor speed sensors
21/08 . . Indirect field-oriented control; Rotor flux feed-forward control
21/09 . . . Field phase angle calculation based on rotor voltage equation by adding slip frequency and speed proportional frequency
21/10 . . Direct field-oriented control; Rotor flux feed-back control
21/12 . Stator flux based control involving the use of rotor position or rotor speed sensors
21/13 . Observer control, e.g. using Luenberger observers or Kalman filters
21/14 . Estimation or adaptation of machine parameters, e.g. flux, current or voltage
21/141 . . {Flux estimation}
21/143 . . {Inertia or moment of inertia estimation}
21/16 . . Estimation of constants, e.g. the rotor time constant
21/18 . . Estimation of position or speed
21/20 . . Estimation of torque
21/22 . Current control, e.g. using a current control loop
21/24 . Vector control not involving the use of rotor position or rotor speed sensors
21/26 . . Rotor flux based control
21/28 . . Stator flux based control
21/30 . . . Direct torque control [DTC] or field acceleration method [FAM]
21/32 . . Determining the initial rotor position (H02P 21/34 takes precedence)
21/34 . Arrangements for starting
21/36 . Arrangements for braking or slowing; Four quadrant control
21/50 . {Vector control arrangements or methods not otherwise provided for in H02P 21/00- H02P 21/36}

23/00 **Arrangements or methods for the control of AC motors characterised by a control method other than vector control**

NOTE

When classifying in this group, subject matter also relating to groups H02P 21/00, H02P 25/00 or H02P 27/00 is further classified in those groups whenever appropriate.

23/0004 . {Control strategies in general, e.g. linear type, e.g. P, PI, PID, using robust control}
23/0009 . . {using sliding mode control}
23/0013 . . {using fuzzy control}
23/0018 . . {using neural networks}
23/0022 . . {Model reference adaptation, e.g. MRAS or MRAC, useful for control or parameter estimation}
23/0027 . . {using different modes of control depending on a parameter, e.g. the speed}
23/0031 . . {implementing a off line learning phase to determine and store useful data for on-line control}
23/0077 . {Characterised by the use of a particular software algorithm}
23/0086 . {specially adapted for high speeds, e.g. above nominal speed}
23/009 . . {using field weakening}
23/02 . specially adapted for optimising the efficiency at low load
23/03 . specially adapted for very low speeds
23/04 . specially adapted for damping motor oscillations, e.g. for reducing hunting
23/06 . Controlling the motor in four quadrants
23/07 . . Polyphase or monophase asynchronous induction motors
23/08 . Controlling based on slip frequency, e.g. adding slip frequency and speed proportional frequency
23/10 . Controlling by adding a dc current
23/12 . Observer control, e.g. using Luenberger observers or Kalman filters
23/14 . Estimation or adaptation of motor parameters, e.g. rotor time constant, flux, speed, current or voltage
23/16 . Controlling the angular speed of one shaft (H02P 23/18 takes precedence)
23/18 . Controlling the angular speed together with angular position or phase
23/183 . . {of one shaft without controlling the prime mover}
23/186 . . {of one shaft by controlling the prime mover}
23/20 . Controlling the acceleration or deceleration
23/22 . Controlling the speed digitally using a reference oscillator, a speed proportional pulse rate feedback and a digital comparator

23/24 . Controlling the direction, e.g. clockwise or counterclockwise
23/26 . Power factor control [PFC]
23/28 . Controlling the motor by varying the switching frequency of switches connected to a DC supply and the motor phases
23/30 . Direct torque control [DTC] or field acceleration method [FAM]

25/00 Arrangements or methods for the control of AC motors characterised by the kind of AC motor or by structural details

NOTE

When classifying in this group, subject matter also relating to groups H02P 21/00, H02P 23/00 or H02P 27/00 is further classified in those groups whenever appropriate.

25/02 . characterised by the kind of motor
25/022 . . Synchronous motors (H02P 25/064 takes precedence)
25/024 . . . controlled by supply frequency
25/026 . . . . thereby detecting the rotor position
25/028 . . . with four quadrant control
25/03 . . . with brushless excitation
25/032 . . Reciprocating, oscillating or vibrating motors
25/034 . . . Voice coil motors (voice coil motors driven by DC H02P 7/025)
25/04 . . Single phase motors, e.g. capacitor motors
25/06 . . Linear motors
25/062 . . . of the induction type
25/064 . . . of the synchronous type
25/066 . . . . of the stepping type
25/08 . . Reluctance motors
25/0805 . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
25/083 . . . Arrangements for increasing the switching speed from one coil to the next one
25/086 . . . Commutation
25/089 . . . . Sensorless control (direct torque control H02P 23/30)
25/092 . . . Converters specially adapted for controlling reluctance motors
25/0925 . . . . {wherein the converter comprises only one switch per phase}
25/098 . . . Arrangements for reducing torque ripple
25/10 . . Commutator motors, e.g. repulsion motors
25/102 . . . {Repulsion motors}
25/105 . . . {Four quadrant control}
25/107 . . . {Polyphase or monophase commutator motors}
25/12 . . . with shiftable brushes
25/14 . . . Universal motors (H02P 25/12 takes precedence)
25/145 . . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value, speed feedback}
25/16 . characterised by the circuit arrangement or by the kind of wiring
25/18 . . with arrangements for switching the windings, e.g. with mechanical switches or relays
25/182 . . . {whereby the speed is regulated by using centrifucal devices, e.g. switch, resistor}
25/184 . . . {wherein the motor speed is changed by switching from a delta to a star, e.g. wye, connection of its windings, or vice versa}
25/186 . . . {whereby the speed is regulated by using a periodic interrupter (H02P 25/30 takes precedence)}
25/188 . . . {wherein the motor windings are switched from series to parallel or vice versa to control speed or torque}
25/20 . . . for pole-changing
25/22 . . Multiple windings; Windings for more than three phases
25/24 . . Variable impedance in stator or rotor circuit
25/26 . . . with arrangements for controlling secondary impedance
25/28 . . using magnetic devices with controllable degree of saturation, e.g. transductors
25/30 . . the motor being controlled by a control effected upon an ac generator supplying it
25/32 . . using discharge tubes
25/325 . . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}

27/00 Arrangements or methods for the control of AC motors characterised by the kind of supply voltage (of two or more motors H02P 5/00; of synchronous motors with electronic commutators H02P 6/00; of DC motors H02P 7/00; of stepping motors H02P 8/00)

NOTE

When classifying in this group, subject matter also relating to groups H02P 21/00, H02P 23/00 or H02P 25/00 is further classified in those groups whenever appropriate

27/02 . using supply voltage with constant frequency and variable amplitude
27/024 . . using AC supply for only the rotor circuit or only the stator circuit
27/026 . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
27/04 . using variable-frequency supply voltage, e.g. inverter or converter supply voltage
27/045 . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
27/047 . . {V/F converter, wherein the voltage is controlled proportionally with the frequency}
27/048 . . using AC supply for only the rotor circuit or only the stator circuit
27/05 . . using AC supply for both the rotor and the stator circuits, the frequency of supply to at least one circuit being variable
27/06 . . using dc to ac converters or inverters (H02P 27/05 takes precedence)
27/08 . . . with pulse width modulation
27/085 . . . . {wherein the PWM mode is adapted on the running conditions of the motor, e.g. the switching frequency}
27/10 . . . . using bang-bang controllers

27/12 . . . . pulsing by guiding the flux vector, current vector or voltage vector on a circle or a closed curve, e.g. for direct torque control
27/14 . . . . with three or more levels of voltage
27/16 . . using ac to ac converters without intermediate conversion to dc (H02P 27/05 takes precedence)
27/18 . . . varying the frequency by omitting half waves

29/00 Arrangements for regulating or controlling electric motors, appropriate for both AC and DC motors (arrangements for starting electric motors H02P 1/00; arrangements for stopping or slowing electric motors H02P 3/00; control of motors that can be connected to two or more different electric power supplies H02P 4/00; regulating or controlling the speed or torque of two or more electric motors H02P 5/00; vector control H02P 21/00)

29/0016 . {Control of angular speed of one shaft without controlling the prime mover}
29/0022 . . {Controlling a brake between the prime mover and the load}
29/0027 . . {Controlling a clutch between the prime mover and the load}
29/02 . Providing protection against overload without automatic interruption of supply (protection against faults of stepper motors H02P 8/36)
29/024 . . Detecting a fault condition, e.g. short circuit, locked rotor, open circuit or loss of load
29/0241 . . . {the fault being an overvoltage}
29/0243 . . . {the fault being a broken phase}
29/025 . . . {the fault being a power interruption}
29/026 . . . {the fault being a power fluctuation}
29/027 . . . {the fault being an over-current}
29/028 . . . the motor continuing operation despite the fault condition, e.g. eliminating, compensating for or remedying the fault
29/032 . . Preventing damage to the motor, e.g. setting individual current limits for different drive conditions
29/04 . by means of a separate brake
29/045 . . {whereby the speed is regulated by measuring the motor speed and comparing it with a given physical value}
29/10 . for preventing overspeed or under speed
29/20 . for controlling one motor used for different sequential operations
29/40 . Regulating or controlling the amount of current drawn or delivered by the motor for controlling the mechanical load
29/50 . Reduction of harmonics
29/60 . Controlling or determining the temperature of the motor or of the drive (H02P 29/02 takes precedence)
29/62 . . for raising the temperature of the motor
29/64 . . Controlling or determining the temperature of the winding
29/66 . . Controlling or determining the temperature of the rotor
29/662 . . . {the rotor having permanent magnets (H02P 29/67 takes precedence)}
29/664 . . . {the rotor having windings}
29/666 . . . . {by rotor current detection}
29/67 . . {Controlling or determining the motor temperature by back electromotive force [back-EMF] evaluation}
29/68 . . based on the temperature of a drive component or a semiconductor component
29/685 . . . {compensating for Hall sensor temperature non-linearity}

31/00 Arrangements for regulating or controlling electric motors not provided for in groups H02P 1/00 - H02P 5/00, H02P 7/00 or H02P 21/00 - H02P 29/00

Indexing scheme associated with groups relating to the arrangements for controlling electric generators

2101/00 Special adaptation of control arrangements for generators
2101/10 . for water-driven turbines
2101/15 . for wind-driven turbines
2101/20 . for steam-driven turbines
2101/25 . for combustion engines
2101/30 . for aircraft
2101/35 . for ships
2101/40 . for railway vehicles
2101/45 . for motor vehicles, e.g. car alternators

2103/00 Controlling arrangements characterised by the type of generator
2103/10 . of the asynchronous type
2103/20 . of the synchronous type

2201/00 Indexing scheme relating to controlling arrangements characterised by the converter used
2201/01 . AC-AC converter stage controlled to provide a defined AC voltage
2201/03 . AC-DC converter stage controlled to provide a defined DC link voltage (general aspects of plural converters in cascade H02M)
2201/05 . Capacitive half bridge, i.e. resonant inverter having two capacitors and two switches
2201/07 . DC-DC step-up or step-down converter inserted between the power supply and the inverter supplying the motor, e.g. to control voltage source fluctuations, to vary the motor speed (general aspects of plural converters in cascade H02M)
2201/09 . Boost converter, i.e. DC-DC step up converter increasing the voltage between the supply and the inverter driving the motor (general aspects of plural converters in cascade H02M)
2201/11 . Buck converter, i.e. DC-DC step down converter decreasing the voltage between the supply and the inverter driving the motor (general aspects of plural converters in cascade H02M)
2201/13 . DC-link of current link type, e.g. typically for thyristor bridges, having an inductor in series with rectifier
2201/15 . Power factor Correction [PFC] circuit generating the DC link voltage for motor driving inverter (motor power factor control H02P 23/26)

2203/00 Indexing scheme relating to controlling arrangements characterised by the means for detecting the position of the rotor

2203/01 . Motor rotor position determination based on the detected or calculated phase inductance, e.g. for a Switched Reluctance Motor

2203/03 . Determination of the rotor position, e.g. initial rotor position, during standstill or low speed operation

2203/05 . Determination of the rotor position by using two different methods and/or motor models

2203/07 . Motor variable determination based on the ON-resistance of a power switch, i.e. the voltage across the switch is measured during the ON state of the switch and used to determine the current in the motor and to calculate the speed

2203/09 . Motor speed determination based on the current and/or voltage without using a tachogenerator or a physical encoder

2203/11 . Determination or estimation of the rotor position or other motor parameters based on the analysis of high frequency signals (position detection of motors with electronic commutators in dependence of the position H02P 6/185)

2205/00 Indexing scheme relating to controlling arrangements characterised by the control loops

2205/01 . Current loop, i.e. comparison of the motor current with a current reference

2205/03 . Power loop, i.e. comparison of the motor power with a power reference

2205/05 . Torque loop, i.e. comparison of the motor torque with a torque reference

2205/07 . Speed loop, i.e. comparison of the motor speed with a speed reference

2207/00 Indexing scheme relating to controlling arrangements characterised by the type of motor

2207/01 . Asynchronous machines

2207/03 . Double rotor motors or generators, i.e. electromagnetic transmissions having double rotor with motor and generator functions, e.g. for electrical variable transmission

2207/05 . Synchronous machines, e.g. with permanent magnets or DC excitation

2207/055 . . Surface mounted magnet motors

2207/07 . Doubly fed machines receiving two supplies both on the stator only wherein the power supply is fed to different sets of stator windings or to rotor and stator windings

2207/073 . . wherein only one converter is used, the other windings being supplied without converter, e.g. doubly-fed induction machines

2207/076 . . wherein both supplies are made via converters: especially doubly-fed induction machines; e.g. for starting

2209/00 Indexing scheme relating to controlling arrangements characterised by the waveform of the supplied voltage or current

2209/01 . Motors with neutral point connected to the power supply

2209/03 . Motors with neutral point disassociated, i.e. the windings ends are not connected directly to a common point

2209/05 . Polyphase motors supplied from a single-phase power supply or a DC power supply

2209/07 . Trapezoidal waveform

2209/09 . PWM with fixed limited number of pulses per period

2209/095 . . One pulse per half period

2209/11 . Sinusoidal waveform

2209/13 . Different type of waveforms depending on the mode of operation