Department of Electrical Engineering IIT Delhi

EEL 841 Solid State Controllers for Drives

Max Marks 40 MAJOR TEST 05/05/07 Time 2hrs

Attempt All questions

Q1 (a) In a 3-phase, 2-pole squirrel cage, distributed stator winding induction motor, fed from a 50 Hz, 3-phase six stepped inverter, from the basic principles derive the expression for MMF waveform in terms of 'h' and 'k' th order space and time harmonics. [5]

(b) For the above operating conditions, ~~give~~ obtain the speed and direction of rotation the MMF harmonics with respect to the synchronous speed induction motor for the following space and time harmonics

(i) h = 17 and K = 11 (ii) h = 13 and k = 31 and (iii) h = 7 and k = 7 [5]

Q2. In a magnetisation flux oriented indirect vector control of a 3-phase squirrel cage induction motor drive, from the basic principles obtain the expressions for ω_{sl} and decoupling signal i_{dq} in synchronously rotating reference frame with $\psi_{qm} = 0$ and $\psi_{dm} = \psi_m$ net flux linkage. Draw suitable phasor diagram and the block diagram for the above decoupling control [10]

Q3. (a) A 8/6 pole SRM has stator/rotor pole angles of 20°; draw the inductance profiles for four phases of the stator. The SRM is fed from a 100V DC supply has $L_{min} = 5mH$ and $L_{max} = 20mH$ it draws 5 Amp under steady state condition with $\omega_r = 100 rad/s$. It has a rotor position encoder having four optical sensors and interrupting disk with the rotor profile. Sensors are placed on the ~~left~~ edge

obtain the sensor signals in real time. [5]

(b) Give suitable hardware layout for the above mentioned ~~dr~~ SRM drive closed loop control using TI 32 bit DSP, supported by a control block diagram. Give flow chart for a software algorithm for the abovementioned drive while its operation in real time. [5]

Q4. (a) Give description of operation of a PMBLDC motor which is a trapezoidal voltage SPM drive. Give suitable layout and control signals for a feedback mode 2/3 angle switch on mode operation in PWM mode, current controlled operation for a 3-phase stator winding layout and its power circuit. [6]

(b) Above PMBLDC motor is fed from a 100V DC supply having base speed of 500rpm, runs with trapizordial back voltage of 45 V (peak). Find its running speed. If the input current be 10A DC, obtain the resistance per phase. [4]

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