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Question Paper Code: 22053

M.E. DEGREE EXAMINATION, MAY 2014.

Second Semester

Power Electronics and Drives

01PPE203 - SPECIAL ELECTRICAL MACHINES AND CONTROLLERS

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Write the voltage and torque equations of a synchronous reluctance motor.
2. What is the main advantage of synchronous reluctance motor?
3. Draw the general Speed-Torque characteristics of SRM.
4. What is the significance of closed loop control in switched reluctance motor?
5. What is the magnitude of stator current in PMSM to achieve demagnetization?
6. Synchronous machines with surface-mount magnets have very little difference between direct axis and quadrature axis inductances- why?
7. Draw the magnetic circuit of two pole permanent magnet Brushless DC motor.
8. What are the advantages of PMBLDC motor?
9. What is slewing?
10. Define the term stepping angle.

PART - B (5 x 14 = 70 Marks)

11. (a) Explain the construction and operating principle of Linear Induction Motor. (14)

Or

(b) Explain the circle diagram and torque speed characteristics of synchronous reluctance motor. (14)

12. (a) (i) With neat diagram, explain the importance of closed loop control in SR motor. (8)

(ii) Write a note on power controllers used in switched reluctance motors. (6)

Or

(b) With neat diagram, explain the microprocessor based control of switched reluctance motor. (14)

13. (a) Explain the construction and performance of a permanent magnet synchronous motor with neat diagram. (14)

Or

(b) (i) Derive the torque equation of PMSM. (7)

(ii) Explain with phasor diagram, the measurement of L_d and L_q in PMSM. (7)

14. (a) (i) Explain with neat diagram and waveforms, the full wave inverter based PMBLDC motor. (8)

(ii) Draw and explain the speed torque characteristics of PMBLDC motor. (6)

Or

(b) Sketch the structure of controller for PMBLDC motor and explain the function of various blocks. (14)

15. (a) (i) Describe the operation of variable reluctance type stepper motor. Also explain about micro stepping. (9)

(ii) Explain the working of hybrid motor. (5)

Or

(b) (i) Draw and explain the torque pulse rate characteristics of stepper motor. (9)

- (ii) What is stepping angle? Calculate the stepping angle for a 3 phase 24 pole permanent magnet type stepper motor. (5)

PART - C (1 x 10 = 10 Marks)

16. (a) A PMBLDC motor has torque constant 0.12 Nm/A referred to DC supply. Find no load speed when connected to 48V DC supply. Find stall current and stall torque if armature resistance is 0.15Ω / phase and drop in controller transistors is 2V . (10)

Or

- (b) A Switched Reluctance motor with 6 stator poles and 4 rotor poles has a stator pole arc of 30° and rotor pole arc of 32° . The aligned inductance is 10.7mH and unaligned inductance is 1.5 mH . Saturation can be neglected. Calculate the instantaneous torque when the rotor is 30° before the aligned position and the phase current is 7A . (10)
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