EE 415: Electrical Drives & Control (3-0-2:4)

Fundamentals of Electric Drives

Electrical drives and introduction: Electric drives, advantages of electrical drives, parts of electrical drives, choice of electrical drives, status of ac and dc drives, Speed Sensing and current Sensing.

Dynamics of Electrical Drives

Fundamental torque equation, speed-torque convention and multi quadrant operation, , dynamics of motor load combination, Types of load, load with translational motion, load with rotational motion, load torque that vary with time nature and classification of load torque, measurement of moment of inertia, calculation of acceleration time in transient operation, acceleration time for specific nature of motor and load torque, load equalization, stability of electrical drives. Selection of Motor Power Rating.

Power Electronics control of DC drives

Review of DC Motors and its performance, starting, braking, controlled rectifier fed DC drives with continuous and discontinuous mode of operation, Supply Harmonics, Power Factor and ripple in motor current, Chopper Controlled DC Drives, Sources current harmonics in chopper, Converter Ratings and closed loop control.

Power Electronics control of AC drives

Review of Three phase Induction Motor and its performance, starting, braking, Static Voltage control, Variable Frequency Control (VSI, CSI, Cyclo-converter based), static rotor resistance control and slip power recovery control schemes.

Three phase Synchronous Motors

Review of Three phase Synchronous Motor and its performance, Self controlled schemes, Variable frequency control of multiple synchronous motor, Permanent magnet AC motor drives, Brushless DC Motor Drives.

List of Experiments

I. Hardware:

1. Study of Speed Control of DC Shunt Motor Using Single Phase Fully Controlled/Half Controlled Converter.
2. Study of Speed Control of DC Shunt Motor Using Three Phase Fully Controlled/Half Controlled Converter.
3. Study of Speed Control of DC Shunt Motor Using DC Chopper.
4. Study of Speed Control for Three Phase Induction Motor with static rotor resistance control method.
5. Study of Speed Control for Three Phase Induction Motor with 'V/f' method.
6. Study of DSP/FPGA Controlled Induction Motor Drive.
7. Study of DSP/FPGA Controlled DC Motor Drives.
8. Study of Vector Controlled Induction Motor Drive.

II. Software:

1. PSIM simulation of single-phase AC voltage controller using TRIAC with (i) R, (ii) RL (iii) RLE load & (iv) Motor load.
2. PSIM simulation of DC chopper with (i) R,(ii) RL , (iii) RLE load & (iv) Motor load.

3. P-SIM simulation of 3-phase bridge Voltage Source Inverter (180◦ mode) with (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
4. P-SIM Simulation of three phase Current Source Inverter (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
5. PSIM simulation of single-phase full-wave fully controlled rectifier with (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
6. PSIM simulation of single-phase full-wave half controlled rectifier with (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
7. PSIM simulation of three-phase full-wave fully controlled rectifier with (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
8. PSIM simulation of three-phase full-wave half controlled rectifier with (i) R, (ii) RL , (iii) RLE load & (iv) Motor load.
9. P-SIM Simulation of 3-phase bridge Voltage Source Inverter (PWM mode) with (i) R,(ii) RL , (iii) RLE load & (iv) Motor load.

Text Books:

1. Dubey G.K, “Fundamentals of Electrical Drives”, Narosa Publishing House
2. Pillai S.K., “A First Course on Electrical Drives”, New Age International

References:

3. De N.K., Sen P.K. “Electric Drives”, Prentice Hall of India
4. Krishna. R, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall of India
5. Ned Mohan et al, “Power Electronics: Converters, Applications, and Design”, John Wiley & Sons. Inc.
6. Werner Leonhard, “Control of electrical drives”, Springer