

Electrical Drives

MEP 1523 / 1522

Lecturer: Dr. Nik Rumzi Nik Idris
E-mail: nikrumzi@ieee.org
Phone: 07-55 35206, 07-55 35341
URL: <http://encon.fke.utm.my/courses/mep1523/>

Evaluation:

Assignments 1,2 &3	30%
Mid Semester test	20%
Final exams:	50%

Course Outcomes:

- Be able to understand the principle of electrical drives
- Be able to understand the dynamics of electrical drive systems
- Be able to select suitable converters and their controls for drive applications
- Be able to use MATLAB/SIMULINK in simulating and designing of controllers for electrical drive systems.
- Be able to explain the principles of vector control drives.

Module 1 Introduction to Electrical Drives

Elements of Modern Electrical Drives

Dynamics of Motor-Load System

- Equivalent rotating system and fundamental torque equations

Components of load torque

Load and Motor torque-speed characteristics

Quadrant of operations

Steady state stability

Thermal consideration

Module 2 Power Electronic Converters in Electrical Drives

Controlled rectifier: modelling, control and simulation

Switched-mode converters: modelling, control and simulation

Current ripple in current controlled converters

Current Control Converters:

- hysteresis
- ramp comparison in stationary and rotating frames

Space Vector Modulation

Simulation of PE Converters

Module 3 DC motor drives

Construction, modeling and transfer function of the DC machine

Converters for DC drives & quadrant of operations

Closed-loop control of DC drives & MATLAB/SIMULINK

Simulation of DC motor drives

Module 4 Induction motor drives

Induction motor: Steady state equivalent circuit

- Scalar control: open loop constant V/Hz control:
- Current control constant V/Hz

Dynamic modelling of IM

Vector control: rotor flux, stator flux and direct torque control

Simulation of AC motor drives

References

There is no specific textbook for this course. Students are encouraged to read the notes given on the course website. List of recommended reading assignment is also provided for those who want to probe further.

Books

- [1] Ned Mohan , "Electric Drives: An integrative approach", MNPERE, Minneapolis, USA, 2001
- [2] G.K. Dubey, -Fundamental of Electrical Drives", Narosa, 1994.
- [3] R. Krishnan, -Electric motor drives", Prentice-Hall, 2001
- [4] N. Mohan, -Power Electronics: Converters, applications and design" John Wiley and Sons, 1995.
- [5] W. Leonhard, -Control of electrical drives", Springer-Verlag, 1984.
- [6] J. M. D. Murphy and F.G. Turnbull, -Power electronic control of AC motor", Pergamon press, 1988.
- [7] B.K. Bose, -Power electronics and AC drives", Prentice-Hall, 2002
- [8] D.W. Novotny &T.A. Lipo, -Vector control and dynamics of AC drives", Oxford Science Publicatios, 1996.
- [9] M.A. El-Sharkawi, -Fundamentals of Electric Drives", Brooks/Cole, 2000

Papers

- [10] J. Holtz, W. Lotzkat and A. Khambadkone, -On continuous control of PWM inverters in the overmodulation range including the six-step mode", IEEE Transactions on Power Electronics, Vol 8, No 4, pp 546-553, Oct 1993
- [11] I. Takahashi and T. Noguchi, -A new quick-response and high-efficiency control strategy of an induction motor", IEEE Trans. Ind. Appl. Vol. IA-22, No. 5, pp. 820-827. Sept. /Oct. 1986.
- [12] X. Xu, R. K. Doncker, D.W. Novotny, -A stator flux oriented Induction machine drive", IEEE-PESC, 1988.