

固態電機控制 (Solid-State Electric Machine Control)

A. 課程概述與目標

This course introduces the theories and operation affairs of static and dynamic characteristics of various electric machines. In addition, some power converters are also introduced. The theoretic backgrounds established from this course will be helpful for performing the research in the fields of motor drive, power electronics and control engineering.

B. 先修科目或先備能力：學生須具備“電動機械”課程之基本能力

(Others: Electric circuit theory, Electromagnetic, Electronics, Power electronics)

C. 教科書 (Text books)

1. R. Krishnan, *Electric Motor Drives Modeling, Analysis and Control*, Prentice Hall, New Jersey, 2001.
2. Handouts.

D. 課程綱要 (Course contents)

1. Introduction to electric machine control and mechatronics: (1) Electric machines; (2) Mechanical system; (3) Power electronics; (4) Control system; (5) Applied electronics.
2. Overview of sensors and transducers: (1) Specifications; (2) Some commonly used sensors in motor drives; (3) Commonly used signal conditioning circuits.
3. Overview of magnetic circuits and electromechanical energy conversion: (1) Magnetic equivalent circuits; (2) Energy conversion process; (3) Mechanical force and torque in the electromagnetic system.
4. Structures, operation principles, comparative characteristics of commonly used electric machines: (1) Machine structures. (2) The commonly used converters; (3) Voltage and torque equations; (4) Control approaches; (5) Key issues for enhancing the driving performance of commonly used electric machines.
5. Power electronic converters for motor drives: (1) Overview of power semiconductor devices; (2) Introduction to harmonic analysis and modulation techniques for inverters; (3) PWM inverters for AC motor drives; (4) Some matching issues between motor, converter and mechanical load.
6. Modeling and control of motor drive: (1) Dynamic modeling of motor drives; (2) Practical controllers for motor drives; (3) Controller realization.
7. Key issues of commonly used motor drives: (1) Stepping motors: Structures, driving control and applications; (2) Switched-reluctance machines and other special machines; (3) DC motors; (4) Induction motor drives and vector control; (5) Synchronous motors, permanent magnet synchronous motors and brushless DC motors control; (6) Linear motor drives; (7) Voice coil motor drives.
8. Future trend and applications of commonly used motor drives: (1) Choice of motor drives; (2) Application for motor drives.

E. 參考書籍 (References)

- [1] M. Jacob, *Power electronics: Principles and applications*, Delmar Thomson Learning, 2002.
- [2] G. K. Dubey, *Power semiconductor controlled drives*, Alpha Science, UK, 2001.
- [3] N. Mohan et al., *Power electronics: Converters, Applications and Design*, 3rd Ed., John Wiley & Sons, Inc., 2003.
- [4] B. K. Bose, *Modern Power Electronics and AC Drives*, Prentice Hall, New Jersey, 2002.
- [5] B. K. Bose, *Power Electronics and Motor Drives: Advances and Trends*, Academic Press, 2006.
- [6] P. C. Krause, O. Wasynczuk, and S. D. Sudhoff, *Analysis of electric machinery and drive systems*, 3rd ed., New York: Wiley-IEEE, 2013.

F. 教學方式 (Teaching Method): 面授 (Lecture).

G. 成績考核 (Evaluation): 作業, 期中考, 期末考.

H. 可連結之網頁位址: 系建個人網址: <http://www.ee.nthu.edu.tw/cmliaw/>