Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

Course Specification Document

Title	Electric Motor Drives

Credits	3.5 ECTS

Aims	This course aims to provide the student with the knowledge related to the analysis, design, and evaluation of the performance of electric motor drive circuits to suit industrial applications, and to enable him to understand the impact of the drive circuit on motor performance. It also aims to provide him with the ability to design control laws for controlling the torque, speed, and position of electric motors.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Identify the basic components of electric motor drive systems.
- Understand the performance requirements of electric motor control drive circuits.
- Identify methods for designing and selecting the essential elements in motor drive circuits.
- Identify methods for designing cascaded control loops for electric motor drives.
- Design and implement electric motor drives that achieve desired performance specifications.
- Implement computer models to simulate electric motor control systems and verify their performance.
- Design and implement speed control laws for several types of electric motors.

Syllabus

- **General introduction to electric motor drive systems:** overview of the general diagram of electric motor drive systems, the basic components of drive systems, industrial applications, and existing industrial solutions.
- **DC Motor drives:** review of DC motors and their characteristics, quadrant operation, analysis and design of switching mode PWM/Thyristor converter and motor circuits, control of motor torque/speed and position through cascade control loops.
- **Induction motor drives:** review of induction motors and their characteristics, dynamic model of induction motor, methods of changing the speed and scalar control of the induction motor speed, analysis and design of three-phase AC motor control circuits, design of torque/speed and position controllers based on steady-state model.
- **Synchronous motor drives:** recap of synchronous motors and their characteristics, dynamic model of the synchronous motor, self-control of the synchronous motor, voltage and current source synchronous motor circuit, design of torque/speed and position controllers using the steady-state model.

- **Brushless DC motor drives:** operating principle and properties of the BLDC motors, motor back EMF and ideal current waveforms, inverter drive BLDC motors, specifications of the sensors used in the motor drive circuit, torque and speed control.
- **Vector control of permanent synchronous motor:** the principle of field-oriented control of three-phase AC motors and its advantages, the conversion from natural three-phase frames to stationary and synchronous two-phase frames, the dynamic model of the motor and the expression of torque in stationary and synchronous frames, design of torque/speed and position regulators.