Machine control

Component
École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

In brief

- **Ametys Code:** N8EE15D
- **Open to exchange students:** Yes

Presentation

Objectives

1- Become familiar with the various components of a variable speed drive for three-phase electric machines.
2- Learn how to model electric machines for control purposes.
3- Implement vector controls for three-phase electric machines.
4- Synthesise scalar controls for synchronous and asynchronous machines.
5- Raise awareness of the issues involved in high-speed operation.

Description

This course enables students to apply the skills they have acquired in automation and electrical machine modelling to design variable speed drives for inverter-powered electrical machines.

To achieve this objective, the first chapter presents the principle of DC machine control, which forms the basis for the control of three-phase electrical machines. The different models of synchronous and asynchronous machines are reviewed, specifying the limitations of their use for the synthesis of control laws.

Next, using Park's transform, models dedicated to the control of synchronous and asynchronous machines are presented, detailing the specific features of each type of machine. These models serve as the basis for the design of control systems in variable speed drives for different machines. Methods for synthesising control loops (electromagnetic torque, speed, position) are presented, discussing the limitations imposed by the machine (current limitation) and by the inverter (limited voltage). Pulse width modulation (PWM) methods for inverter control by continuous controllers are also presented.

Finally, the possibility of reaching different operating points in the torque-speed plane is discussed, detailing the strategies for calculating references for both types of machines. Issues specific to high-speed control are introduced.

Pre-requisites

N7EE03B - Electromagnetic modelling of machines

N7EE03F - Principles and structures of electrical machines

N7EE05C - Synthesis of correctors and control architectures

N7EE04D - Modulation and filtering of voltage inverters