Electrical Systems Control

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

- **Ametys Code:** N9EE19E
- **Open to exchange students:** Yes

Presentation

Objectives

The main objective is to illustrate and implement, via numerical simulation, general automation principles for electrical energy conversion and processing systems. The aim is therefore to develop expertise in electrical system control by combining knowledge from electrical engineering and system control techniques in the broadest sense.

Description

The first part of the course is devoted to presenting general control concepts from linear, nonlinear, and sampled-data control, as well as some key principles for energy conversion (vector control of electric machines and vector PWM for three-phase inverters). Students then divide into groups (pairs or trios) and choose a topic from a list, which they then simulate using MATLAB-SIMULINK. The process involves modeling and simulating the object to be controlled, followed by designing a control law that meets the specifications. Students must then test and evaluate the performance obtained. At the end of the sessions, each group writes a report detailing the steps taken and the results obtained.

List of topics offered:

· Three-phase PWM rectifier, control on the abc axes + voltage regulator and PLL

Single-phase active filter with PWM loop, RST regulator for currents, and global approach for harmonic references.

· Three-phase active filter with PWM loop, RST regulator for currents, and global approach for harmonic references

- Single-phase rectifier with PWM loop, RST regulator for currents and voltage + PLL
- Smooth-pole synchronous machine, vector control and cascade control for speed and position.

  Smooth-pole synchronous machine, scalar control and state feedback for speed and position.
- Three-phase asynchronous machine, direct vector control and speed control and flux observer.
- Three-phase asynchronous machine, indirect vector control and cascade speed and position control.

Pre-requisites

Linear Systems Automation N7EE05B, N7EE05C, N7EE05D

Electrical Networks N7EE04D

Electrical Machines N7EE03B

Automatic and Nonlinear Systems N8EE13A, N8EE13B, N8EE13C, N8EE13D