

Machine/converter association and their control



Component

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

In brief

- > **Amety's Code:** N8AE13C
- > **Open to exchange students:** No

Presentation

Objectives

1. Become familiar with the various components of a variable-speed drive for three-phase electric machines.
2. Model electric machines for control purposes.
3. Implement vector control for three-phase electric machines.
4. Derive scalar control algorithms for synchronous and asynchronous machines.
5. Introduction to issues related to high-speed operation.

Description

This course enables students to apply the skills they have acquired in control theory and the modeling of electric machines to design speed controllers for electric machines powered by inverters.

To achieve this objective, the first chapter introduces the principles of controlling a DC machine, which forms the basis for controlling three-phase electric machines. A review of the various models of synchronous and asynchronous machines is provided, specifying the limitations of their use for the synthesis of control laws.

Next, using the Park transform, models dedicated to the control of synchronous and asynchronous machines are presented, detailing the specific characteristics of each type of machine. These models serve as the basis for control design in variable-speed drives for the various machines. Methods for synthesizing control loops (electromagnetic torque, speed, position) are presented, discussing

the limitations imposed by the machine (current limitation) and by the inverter (voltage limitation). Pulse width modulation (PWM) methods for controlling the inverter using continuous controllers are also presented.

Finally, the possibility of reaching different operating points in the torque-speed plane is discussed, with a detailed explanation of the strategies for calculating setpoints for both types of machines. Specific issues related to high-speed control are introduced.

Pre-requisites

N6AE04D - Introduction to Electromechanical Conversion

N7AE08A - Machine Models

N7AE03C - Closed-Loop Control of Continuous Linear Systems