Autonomous networks

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

- **Ametys Code:** N9EE25A
- **Open to exchange students:** Yes

Presentation

Objectives

By the end of the module, students will have covered the elements involved in the design and management of onboard and stationary electrical networks. Particular emphasis is placed on onboard and isolated networks. Various fields are used as examples to illustrate the different concepts presented.

By the end of the course, students will be familiar with the architectures of hybrid systems and the energy/power characteristics of energy sources and storage elements. They will be able to analyze the mission of an energy system, assess the relevance of its hybridization, and design and size a hybrid system. Students will also be able to propose an energy management strategy for a multi-source energy system that respects the intrinsic characteristics of the associated sources.

- Understand the architectures of hybrid energy systems.
- Understand the energy/power characteristics of energy sources.
- Be able to analyze an energy system mission and assess the benefits of hybridization.
- Propose an energy management strategy that respects the energy performance of the energy sources in a hybrid system.
- Understand the basic principles of multi-energy systems.
- Analyze technologies and applications that enable the transition between electricity, heat, cooling, and hydrogen.
- Evaluate the integration of different energy sources to optimize performance and efficiency.

· Develop the ability to design and manage hybrid energy systems.

This Design and Research Office has two objectives:

· The first objective is to familiarize students with PEM (Proton Exchange Membrane) fuel cells: assembly, waking up a fuel cell, and tracing the V(I) polarization curve of a fuel cell. It also involves emulating the behavior of a fuel cell when connected to a boost-type (step-up chopper) or buck-type (step-down chopper) static converter.

· The second objective is to simulate the behavior of a fuel cell stack (several fuel cell units connected in series) connected to a boost- or buck-type static converter.

Description

· Design of Embedded Networks Safety and reliability

· Benefits of hybridization in the operation of an embedded network

· Network safety and reliability

· EMC in electrical networks

Autonomous energy systems – hybridization

In addition to theories relating to hybridization and energy management in multi-source systems, the course is based on several examples of hybrid energy systems drawn from the Laplace laboratory's experience in this field of research. These examples relate in particular to the transport sector (aeronautics, rail, and road).

BE "PAC"

· Experimental implementation of a PEM (Proton Exchange Membrane) fuel cell

· Tracing the polarization curve;

· Emulation of static converters using an active load;

· Simulation of the dynamic behavior of the fuel cell.

Multi-Energy Systems

This course is designed to provide students with an in-depth understanding of the integration and management of different forms of energy, including electrical energy, heat, cooling, and hydrogen. It covers the fundamental principles, current technologies, and practical applications of each possible combination, as well as the links between different types of energy.