Guia docent
220119 - 220119 - Vehicles de Propulsió Alternativa

Última modificació: 29/05/2020

Unitat responsable: Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa
Unitat que imparteix: 709 - DEE - Departament d'Enginyeria Elèctrica.

Titulació: GRAU EN ENGINYERIA EN TECNOLOGIES INDUSTRIALS (Pla 2010). (Assignatura optativa).

Curs: 2020 **Crèdits ECTS:** 3.0 **Idiomes:** Anglès

PROFESSORAT

Professorat responsable: JUAN MONTAÑA PUIG

Altres: DAVID GONZALEZ DIEZ

METODOLOGIES DOCENTS

Classroom lectures: In these lectures, teachers will introduce basic concepts of energy storage systems, hybrid arquitecturesarchitectures, electric motors, drives and system modeling. All these explanations are practically oriented and they will be illustrated with real examples to facilitate their understanding.

Practical classes: In these lectures, that are concentrated in modules 3 and 4, students will practice the concepts introduced in previous modules.

Self-study: Students, organized in teamworks, need to work on the materials provided by teachers in order to develop the assigned homework.

Teachers provide the curriculum and monitoring of activities through ATENEA.

OBJECTIUS D'APRENENTATGE DE L'ASSIGNATURA

This course gives an overview of state of the art on alternative propulsion vehicles. It includes a peer description of the main components components, system architectures and operation of common electric powertrains. Most of the contents will be practically introduced by laboratory and modeling implementations.

At the end of the course, students should be able:

- to know the basics principles, components and operation of alternative propulsion systems.
- to model and simulate the performance of these systems.

HORES TOTALS DE DEDICACIÓ DE L'ESTUDIANTAT

Tipus	Hores	Percentatge
Hores aprenentatge autònom	45,0	60.00
Hores grup gran	30,0	40.00

Dedicació total: 75 h

CONTINGUTS

Module 1: Introduction to Alternative Propulsion Vehicles

Descripció:
This module introduces basics on alternative propulsion vehicles. It is focused on pure electric and hybrid electric vehicles. State of the art of current technologies is presented as future trends as well.

Contents:
1.1 General architectures of electric vehicles
1.2 Basic components: motors, power drives and energy storage
1.3 General architectures of hybrid electric vehicles

Objectius específics:
Identify the components of full electric and hybrid electric vehicles.
Understand the function of each component.

Activitats vinculades:
Final exam

Dedicació: 12h 30m
Classes teòriques: 5h
Aprenentatge autònom: 7h 30m

Module 2: Principles of Electric Drives

Descripció:
This module deals with the principles of electric drives focusing on the operation of the typical electric and hybrid-electric power trains.

Contents:

2.1 Battery packs.
2.2 Power processing units for motor-generator and battery packs.
2.3 Operation of typical power trains.

Objectius específics:
-Understand all major components of a typical electric vehicle powertrain
-Describe the operation of accumulators, power electronic converters, motor-generators, on-board and off-board charging systems.

Classify different types of accumulators, power converters and electric machines commonly used in power trains for electric vehicles.

Activitats vinculades:
Final exam.

Dedicació: 12h 30m
Classes teòriques: 5h
Aprenentatge autònom: 7h 30m

Module 3: Laboratory of Electric Machines and Drives

Descripció:
This module is devoted to practice implementation of electric drives. The laboratory is equipped with permanent magnet synchronous motors (PMSM/BLDC) mounted in wheels, three-phase electronic converters and dSPACE platforms for quick experiment implementation with Matlab/Simulink.

Contents:

3.1 Introduction to the laboratory.
3.3 First steps with dSPACE, Simulink, and ControlDesk.
3.2 Basic drive of a PMSM/BLDC motor.
3.3 Throttle control of a PMSM/BLDC motor.
3.4 Brake control of a PMSM motor.
3.5 Regenerative breaking of a PMSM/BLDC motor.

Objectius específics:
To practice with real electric vehicle components.
Programing efficient control techniques for propulsion and breaking.
Familiarize with electric motors, power electronics, rapid prototyping systems and instruments.
Evaluate performance and efficiency

Activitats vinculades:
Laboratory work related to Module 3
Final exam

Dedicació: 25h
Classes teòriques: 10h
Aprenentatge autònom: 15h

Module 4: Modeling & Simulation

Descripció:
This module is devoted to the modeling and simulation of pure electric/hybrid vehicles using numerical simulation. Modeling is useful for system sizing, design an predicting vehicle performance.

Contents:

4.1 Modeling of electric motor.
4.2 Modeling of power electronics converter.
4.3 Modeling of transmission system.
4.4 Modeling of final drive and wheel.
4.5 Modeling of vehicle body

Objectius específics:
Formulate the mechanical physical model of an electric/hybriid vehicle.
Model the electric motor, power electronic converter and batteries.
Determine the performance and evaluate the efficiency.

Activitats vinculades:
Autonomous work related to module 4
Final exam.

Dedicació: 25h
Classes teòriques: 10h
Aprenentatge autònom: 15h

SISTEMA DE QUALIFICACIÓ

BIBLIOGRAFIA

Bàsica:
- Ehsani, M.; Gao, Y.; Emadi, A. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design. 2nd ed. Boca Raton: CRC Press, 2010. ISBN 9781420053982.
- Liu, Wei. Introduction to hybrid vehicle system modeling and control [en línia]. Hoboken: Wiley, 2013 [Consulta: 14/05/2020]. Disponible a: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=918270. ISBN 9781118407387.

Complementària:
- Miller, John M. Propulsion systems for hybrid vehicles [en línia]. 2nd ed. Stevenage, UK: Institution of Engineering and Technology, 2010 [Consulta: 19/05/2020]. Disponible a: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=774057. ISBN 9781849191470.
- Hodkinson, R.; Fenton, J. Lightweight electric/hybrid vehicle design [en línia]. Oxford: Butterworth-Heinemann, 2001 [Consulta: 09/07/2013]. Disponible a: http://www.sciencedirect.com/science/book/9780750650922. ISBN 9780750650922.
- Savaresi, S.M.; Tanelli, M. Active braking control systems design for vehicles. London: Springer, 2010. ISBN 9781849963497.
- Westbrook, Michael H. The electric car: development and future of battery, hybrid and fuel-cell cars. Six Hills Way: The Institution of Electrical Engineers, 2001. ISBN 0852960131.

RECURSOS

Altres recursos:
Documentation available in Atenea