Academic Year/course: 2023/24

67242 - Modeling and Control of Power Electronic Systems

Syllabus Information

Academic year: 2023/24
Subject: 67242 - Modeling and Control of Power Electronic Systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 622 - Master's in Electronic Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Optional
Module:

1. General information

High power electronic systems are present in wind turbines, railway traction, naval propulsion, hydraulic generation, power grid interconnection, heavy industry (steel mills, cement plants, paper mills...), etc. For all these reasons, virtually all the R&D&I programs promoted by the different institutions identify power electronics as one of the key technologies in the sustainable development of the future. Likewise, the irruption of DC distribution networks and the increase in battery storage requirements make the use of bidirectional, high-efficiency DC/DC converters increasingly necessary.

The objective of the course is to provide training in the modelling and control of power electronic converters. The models studied will allow the synthesis of advanced control strategies as well as simulations oriented to validate such strategies.

2. Learning results

Upon completion of this subject, the student will be able to:

- Differentiate large signal models, averaged models and linearized models of power electronic systems.
- Obtain dynamic models of power electronic converters.
- Know state space averaging, circuit averaging and switch averaging modelling methods.
- Simulate industrial power electronics systems.
- Describe the dynamics of electrical power systems in PARK and CLARK coordinates.
- Designing and controlling power electronics systems for bidirectional power exchange.
- Design and control power electronic systems for the control of electrical machines.

3. Syllabus

T1. Accurate modelling of static converters.

T2: Averaged modelling of static converters.

T3: Linearization of nonlinear systems.

T4: Control of static converters.

T5: Power electronic systems for the control of electrical machines.

T6: Power electronic systems for bidirectional electrical energy conversion.

4. Academic activities

In the classroom

The problems or challenge-scenarios will be presented and work will be done, in groups and individually, towards the resolution of the problems or challenge-scenarios posed. The teacher will propose and explain, when necessary, the tools and methodologies that enable the resolution of such problems or challenge scenarios.

In the laboratory

Practices will be structured in 6 sessions of 2.5 hours each. All of them are at the service of and complement the work done in class.

5. Assessment system

1: Final exam (50%):

Grade (C1) from 0 to 5 points. It will represent 50% of the student's overall grade. In order to pass the subject, the student

must obtain a minimum grade in this section of 2 points out of 5.

2: Laboratory practices and associated work (50%):

Grade (C2) from 0 to 5 points, will represent 50% of the student's overall grade. In order to pass the subject, the student must obtain a minimum grade in this section of 3 points out of 5.

3: Overall rating:

The subject will be assessed by the continuous assessment system by means of the activities described above.

The global evaluation of the student will be carried out in the two official calls by means of the following tests:

Final exam problems: grade C1 from 0 to 5 points (50%).

Laboratory exam: grade C2 from 0 to 5 points (50%). Students will be exempted from this exam if the C2 grade obtained in the laboratory practices and associated work during the academic year. is higher than or equal to 3 points out of 5.

The total grade for the subject (out of 10 points) will be C1 + C2, provided that C1 is higher than or equal to 2 and C2 is higher than or equal to 3. Otherwise, the total grade for the subject will be the minimum between C1 + C2 and 4. The subject is passed with a total grade higher or equal to 5 points out of 10.