

29629 - Electric motor drives

Syllabus Information

Academic year: 2023/24

Subject: 29629 - Electric motor drives

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 430 - Bachelor's Degree in Electrical Engineering

ECTS: 6.0

Year: 3

Semester: Second semester

Subject type: Compulsory

Module:

1. General information

Drives of Electrical Machines is a compulsory subject of 6 ECTS credits of the third year of the electrical degree, which is equivalent to 150 total working hours, corresponding to 60 classroom hours (theory classes, problems, laboratory...)

Within the industrial field, industrial drives with electric motors represent a fundamental part in manufacturing processes and are, therefore, a mandatory subject of knowledge for a graduate in Electrical Engineering. Currently, and due to the widespread development of electric vehicles and renewable energies, an immense field of use of converters for the control of electric machines has opened up. This subject analyzes electric machine drives from a technical point of view, studying their proper selection and applicability to different industrial processes.

2. Learning results

- 1- Have the ability to apply quantitative methods and computer programs to the analysis and design of electrical machines to solve engineering problems.
- 2: Understands and know how to apply system approaches to engineering problems involving electrical machines.
- 3: Have the ability to investigate and define a problem and identify constraints in the analysis, design and operation of electrical machines.
- 4: Understand the user and consumer needs in the selection of electrical machines, the corresponding drives, and/or in the design of such machines.
- 5: Use creativity to establish innovative solutions in the analysis, design and drive of electrical machines.
- 6: Know the characteristics of materials, equipment, processes and products related to the design and drive of electrical machines.
- 7: Have laboratory and workshop skills.
- 8: Include the use of technical literature and other sources of information.

3. Syllabus

1. General information about ACME
2. DC motor drives
 - 2.1. AC/DC drives.
 - 2.1.1. Controlled rectification
 - 2.1.2. Control in several quadrants
 - 2.1.2.1. Antiparallel double converters
 - 2.1.2.2. Control of a DC motor in four quadrants
 - 2.2. DC/DC drives
 - 2.2.1. Principle of operation and types
 - 2.2.2. Control in 4 quadrants: H-bridge converter
3. DC Brushless Drives
4. AC Drives with Asynchronous Squirrel Cage Motors
 - 4.1- The Squirrel Cage Asynchronous Machine
 - 4.2- Static starter
 - 4.3- AC/DC/AC/AC or DC link converters
 - 4.4- AC/AC or direct-link converters

4.5- Filters and chokes for drives with frequency inverters

4.6. Vector Control

4.6.1. Space phasors

4.6.2. Vector Study of the asynchronous machine

4.6.3. Equivalent circuit on dq axes

4.6.4. SVPWM modulation

5. AC Drives with Wound Rotor Motors

4. Academic activities

The teaching of the subject will be by means of face-to-face classes in which after each theoretical block, problems related to that subject will be solved, as well as demonstration and explanation by means of simulink models (through official license of unizar) of the proposed controls. For this purpose, the course notes are available,. Likewise, it will be explained how to develop the control models of electrical machines that the student has to develop weekly in order to pass the subject.

It is mandatory to complete 5 laboratory practices related to the material seen in class and that are part of the final grade.

5. Assessment system

1. Final Exams (60% final grade).

- Theory exam: 25-30 multiple-choice multiple-choice questions (out of 10). No discounts the failed questions, but you must mark all the correct ones to add up.
- Examination of problems: 1 or 2 problems (out of 10)
- The grade of the exam is the average between theory and problems, but in each part you must a minimum of 4 out of 10
- The minimum grade of the exam must be 4 out of 10 to add the rest.

2. Laboratory practicals (10%); they will be evaluated in the laboratory session itself and with the delivery of scripts.

A student who takes an official exam without having taken or passed the exams will not be allowed to take the exam.

the student must pass a practical exam in the laboratory in order to pass the course, and must obtain at least 5 points out of 10.

3. Course work (15%). Resolution of 2 problems representing 10 % each (to be done individually)

4. Weekly exercises (15 %). One individual Matlab exercise will be carried out every two weeks. Download MATLAB R2022b from the SICUZ unizar website.

5. Extraordinary global assessment: Those students who do not follow the ordinary assessment, will take a written exam and a practical laboratory exam. The evaluation of the written exam will be 70% and the laboratory exam, 30% of the overall grade. In both tests they must obtain at least 5 points out of 10.

$Final_grade=0.6*Exam_grade+0.1*Practice_grade+0.15*Work_grade+0.15*Weekly_exercise_grade$