INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Power Electronic Converters			Field of study	Electronics and Instrumentation								
Bachelor in	Electrical and Computers Engineering			School	School of Technology and Management								
Academic Year	2023/2024	Year of study	3	Level	1-3	ECTS credits	6.0						
Type	Semestral	Semester	2	Code	9112-742-3201-00-23								
Workload (hours)	162	Contact hours	T -	TP 30	PL 15	TC -	S -	E -	OT 15	O -			

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Américo Vicente Teixeira Leite

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Describe the operation of the most commonly used power electronic converters based using PWM control.
2. Simulate and analyse the operation of power electronic converters, using simulation tools;
3. Implement and analyse in the laboratory, with a good level of autonomy, power conversion projects: DC/DC buck-boost converter; 4 quadrant DC/DC converter; single-phase voltage source inverter.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Know the main power semiconductor devices widely used and typical driver circuits;
2. Understand direct and alternating current (single-phase and three-phase) circuits.

Course contents

Analysis of power electronic converters – circuits, control and applications: converters from direct current to direct current (DC/DC); converters from direct current to alternating current (DC/AC) – single- and three-phase voltage source inverters; AC/DC converters – single- and three-phase diodo and thyristor rectifiers; AC/AC converters; control methods; harmonic spectrum; applications, namely in electrical drives and with renewable energy sources.

Course contents (extended version)

1. Analysis of power electronic converters:
   - Converters DC/DC: Buck (step-down), Boost (step-up), Buck-Boost, full bridge;
   - Converters DC/AC: single- and three-phase voltage source inverters;
   - AC/DC converters – single- and three-phase diodo and thyristor rectifiers;
   - AC/AC (AC-DC-AC) converters;
   - Control methods and harmonic spectrum;
   - Pulse Width Modulation (PWM) controllers based on dedicated integrated circuits.
2. Applications of power converters in electrical drives and with renewable energy sources.

Recommended reading

1. Power Electronics - Converters, Applications and Design, N. Mohan, T. Undeland, W. Robbins, John Wiley and Sons;
2. Introduction to Power Electronics, Daniel W. Hart, Prentice-Hall;

Teaching and learning methods

Learning outcomes 1: teamwork - analysis and discussion of simulation and laboratory activity results; Learning outcomes 2: teamwork - simulation activities; Learning outcome 3: teamwork - practical and laboratory activities.

Assessment methods

1. Peer assessment - (Regular, Student Worker) (Final)
   - Work Discussion - 50% (Evaluation of LO 1 and 2 based on written criteria.)
   - Laboratory Work - 50% (Evaluation of LO 3 based on written criteria. The overall average is assigned by the teacher.)
2. Final exam - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100% (Written component - 50%; Practical and laboratory component - 50%)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Américo Vicente Teixeira Leite	José Augusto de Almeida Pinheiro Carvalho	José Luís Sousa de Magalhaes Lima	José Carlos Rufino Amaro
14-02-2024	17-02-2024	27-02-2024	02-03-2024