60837 - FPGA-Based Digital Control for Power Converters

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	532 - Master's in Industrial Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

Course grading
The final grade for this course is based on the following weighting:
- Final exam (50 % of grade)
- Pre-lab work, attendance, attitude, and accomplishment during laboratory sessions (30 %)
- Laboratory reports (20 %)

5.Activities and resources

5.1.General methodological presentation

The course includes lectures, exercises and laboratory sessions.

- The theoretical basis of the design of FPGA-based digital electronic systems for power electronic applications will be shown in lectures, illustrated with numerous examples.
- Several sessions will be devoted to apply the theoretical concepts to solve problems and case studies.
- Laboratory sessions will be conducted in small groups where students simulate, program and check the operation of the FPGA-based digital electronic systems.

5.2.Learning activities

Course structure : 2 hours of lectures and 1 hour of problems each week, plus five 3-hour laboratory sessions, one per week for selected weeks throughout the semester. Students will work in groups of two in the laboratory, and the lab reports will be prepared in groups too.

Moodle will be used to communicate announcements and is where students will submit laboratory reports.

5.3.Program

Lecture outline
T0. Introduction.
T1. Design with FPGA for switched-mode power electronic converters.

T2. Arithmetic and VHDL coding
T3. VHDL modeling of switched-mode power converters for testbench generation.
T4. FPGA-based gate signal generation for power electronic converters.
T5. VHDL description of digital controllers for power electronic converters.

Brief description of laboratory sessions
P1. FPGA interface with an A / D converter. Simulation + hands-on.
P2. VHDL Modeling of a Buck converter. Simulation.
P3. FPGA-Based Sigma-delta modulator. Simulation + hands-on.
P4. Digital Control of a Buck converter I. Simulation.
P5. Digital control of a Buck Converter II. Simulation + hands-on.

5.4.Planning and scheduling

Lectures, problem and laboratory sessions are held according to schedule set by the EINA (schedules available on their website).

5.5.Bibliography and recomended resources

All course materials are posted on Moodle.

Basic Bibliography

- J.I. Artigas, L.A. Barragán, C. Orrite, I. Urriza, ?Electrónica Digital. Aplicaciones y problemas con VHDL?, Prentice-Hall, 2002.
- S. Buso, P. Mattavelli, "Digital Control in Power Electronics", Lectures on Power Electronics #2, Morgan & Claypool, 2006.
- L.Corradini, D. Maksimovi?, P. Mattavelli, R.Zane, ?Digital Control of High-Frequency Switched-Mode Power Converters?, IEEE Press Series on Power Engineering, Wiley, 2015.