FEN3219 Advanced Switching in Power Electronics 8.0 credits

Avancerad switchning inom effektelektroniken

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FEN3219 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completion of the course the student shall be able to:

• explain how different resonant converters operate

• explain limitations of different resonant converters

• explain the basic operation of different snubber circuits

• explain how design choices of snubbers affect losses and electric stresses

• explain how different gate-drive circuits operate

• explain basic concepts of good circuit layouts

• calculate peak values of voltages and currents of different resonant converters

• calculate limits in duty ratios, min/max values of voltages/currents for soft-switching

• calculate values of passive components of snubbers

• calculate transient voltages and currents for power devices with snubbers

• calculate suitable values of impedances in gate loops

• describe characteristics of different resonant converters

• describe how parameter choices of resonant converters influence the operation

• describe how resonant converters can increase sustainability

• describe in what way parasitic elements of snubbers influence the effectiveness of the snubber

• describe how gate-drive circuits can withstand high levels of electromagnetic noise

• describe how power devices can be protected from the gate-drive circuit

Course contents

Operation and design of resonant converters, snubbers, and gate-drive circuits:

• Analysis of operation modes of different resonant converters

• Limitations in duty ratio, voltage and current for soft switching

• Methods of control for resonant converters

• Effects of non-idealities of resonant converters

• Energy loss minimization using resonant transitions and relation to sustainability

• Analysis of operation of different snubber circuits

• Electric stress and losses depending on parameter choices for snubbers

• Effects of parasitic elements of snubber circuits

• Good practices when designing gate-drive circuits

• Power device protection in gate-drive circuits

• Good practices for circuit layouts

Specific prerequisites

Examination

• EXA1 - Exam, 8.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

During the seminars the students should show that they are able to absorb the content of a section of the book and then present it in a professional way for the other students. The students should also show that they are capable of taking part in an advanced scientific discussion on the subject.

The project work is a simulation study which is presented in a report. In this report the students shall reflect over how their topic of investigation relates to sustainability. The written examination is a standard examination with the grades P or F.

Other requirements for final grade

• At least one approved seminar with oral presentation

• An approved simulation study on a subject chosen by the examiner

• An approved written examination

Ethical approach

• All members of a group are responsible for the group's work.
• In any assessment, every student shall honestly disclose any help received and sources used.
• In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.

Additional regulations

Course Literature

Mohan/Undeland/Robbins: Power Electronics: Converters, Applications, and Design, John Wiley & Sons,(0471-42908-2, 2003).