EJ2220 Design of Permanent Magnet Synchronous Machines 6.0 credits

Konstruktion av permanentmagnetiserade synkronmaskiner

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

Establishment

Course syllabus for EJ2220 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Language of instruction

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

Intended learning outcomes

The aim of the course is to understand how to make an electromagnetic and thermal design of permanent magnet synchronous machines from any given set of specifications. The knowledge is applied by designing a machine for an industrial application.

After the course, the student should be able to:

- list the different existing topologies of permanent magnet machines
- describe and compare distributed and concentrated windings
- explain the principle of field-weakening for permanent magnet synchronous motors
- choose the appropriate permanent magnet materials for a given construction with regard to functionality, operating conditions, economical and environmental factors
- explain and compare the properties of iron laminations and soft magnetic composites in relation to their use in electrical machines
- enumerate the different loss components in a machine and relate them to different existing models
- develop a simple analytical model of the thermal behaviour of a machine taking into account the relevant losses for the application
- explain all the tasks in the design procedure and apply them to a surface mounted permanent magnet motor with distributed windings with simplified analytical models
- explain discrepancies between results from different analytical methods through knowledge about the various approximations they are based on
- describe the concepts of finite element software tools and apply them in the analysis of permanent magnet synchronous machines
- reflect on the use of analytical models and FEM for optimization
- report and present the results of the design project you have conducted for a chosen application
- do a critical evaluation of the report and presentation of the specific studies conducted by the other students

Course contents

Synchronous electrical machines, permanent magnets, iron lamination, soft magnetic composite, models for losses, thermal modelling, field-weakening, windings, design procedure.

Course literature

Text book Design of Permanent Magnet Synchronous Machines, KTH, 2007.

Examination

- ÖVN1 - Project, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 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.

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

Other requirements for final grade

One oral examination (TEN1; 3cr), 5 project reports (ÖVN1, 1.5cr), two laboratory exercises including preparations (LAB1; 1.5cr).

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.