

Transient Analysis of Electrical Machines, 7.5 credits

Transient analys av elektriska maskiner, 7.5 hp

Second level

Main field: Energy Engineering AIN

Syllabus is adopted by the Research and Education Board (2015-02-24) and is valid for students admitted for the spring semester 2015.

Placement in the Academic System

The course is included in Master's Programme in Renewable Energy Systems

Prerequisites and Conditions of Admission

90 credits in Energy Engineering or equivalent

Course Objectives

This course will provide knowledge and insight within transient analysis of electrical machinery, mainly at fault and various operating conditions. The course will also provide training and skills in the application of research and training in the critical analysis of research results especially when used in practical applications.

Following successful completion of the course the student should

Knowledge and Understanding

- Obtain current and new information on the analysis of the electrical machine operation and be able to use it.
- Understand transient disturbances significance in the wider energy technical context.

Skills and Ability

- Implement an analysis of different operating modes and machine types.
- Thorough understand principles for different types of electrical machines and to be able to suggest appropriate methods depending on the external conditions.
- Implement transient analysis with commercial computer programs.
- Evaluate different calculation results for different installations
- Document the calculation and measurement results.

Judgement and Approach

- Evaluate the technical development and research findings in a larger scientific context.

- Critically evaluate own and others' results and relevance for science

Primary Contents

Transient analysis of electric machines deals with different types of methods used to analyze electric machines operation, particularly during disruption, but also transient events during start and torque steps. The course covers both deduction of the equations needed to describe the said processes for different types of machines, but also practical calculations examples, mainly with computer. The analysis is carried out mostly with numerical integration, the theory for these methods also will be discussed along with solving methods for coupled equations in matrix form. To assess new electrical energy converters in various operating modes requires advanced electrical knowledge, which will be presented in this course. The the course contains the following parts: Electric machines equations for transient events (DC, asynchronous, and synchronous), synchronous machine and subtransient transient reactances, coordinate transformations, Park- and vector-models of electric machines, numerical integration, numerical methods to solving equations, stability for synchronous, machine analysis of different operating modes, network analysis, current research in the area.

Teaching Formats

The course includes lectures, exercises and laboratory tests and field trips. The course includes a comprehensive project work with computer calculations.

The project deals with the development and programming of a transient model for analysis of electric machines, such as the alternator in a wind power plant. The project must be orally presented and reported in writing in a report. Instruction is in English.

Teaching is in English.

Examination

The overall grades of Fail, 3, 4 or 5 will be awarded for the course.

The examination is based on examination and project work

Course Evaluation

made available to the students.

Course evaluation is part of the course. This evaluation should offer guidance in the future development and planning of the course. Course evaluations should be documented and

Course Literature

(Revised 2015-02-19)

Sadarangani, C. *Electrical machines - Design and Analysis of Induction and Permanent Magnet Motors*. KTH, 2006