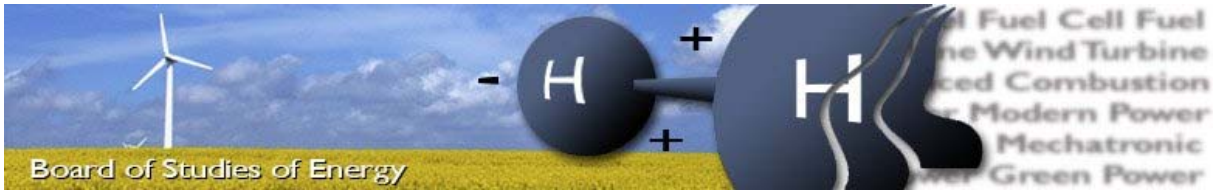


Mechatronic Control Engineering (MCE)

Introduction

Mechatronics, as an engineering discipline, is the synergistic combination of mechanical, electronics, control and computer engineering. The key factor being the integration of these areas during the design process.

The Mechatronic Control Engineering specialization covers the fundamental scientific principles and technologies that are used in the design of modern computer-controlled machines and processes and put special focus on the synergies in the design process.

Today, the technical background necessary for an engineer to design an automated machine, component, or process is very different from that of 30 years ago. The underlying difference is the availability of embedded computers used to control such machines. An automated machine designed 30 years ago would have complicated linkages and cams to define the coordinated motion relationship between functions. Today, such relationships are defined in computer control software. A computer controlled electromechanical system designer not only needs to know proper mechanical design principles, but also needs to know embedded computer control hardware, software and sensors in order to measure variables of interests, and actuation technologies.



Programme description

Mechatronic Control Engineering offers a programme that teaches the student to create and control mechatronic systems and products and develop communication with team members from other disciplines.

The themes for the three semesters are Advanced Control of Electrical Machines, Intelligent Control of Energy Systems and Master Project. These especially focus on Mechatronic Control System Design. The emphasis of the syllabus is on the application and extension of fundamental theory, e.g. in-depth modelling of specific applications and more advanced topics in control theory.

The objectives of the Mechatronic Control Engineering MSc syllabus are:

- That the student should understand the importance of physical and mathematical modelling in mechatronic system design and develop the skill to model and analyze such systems.

- That the student should understand the importance of the integration of modelling and control engineering into the design of mechatronic systems.
- That the student should understand and be able to apply various controller design techniques, e.g. classical feedback control, state-space control and non-linear control methods.
- That the student should acquire a general understanding of more advanced control design techniques, e.g. cascade control, sliding mode control, adaptive control, and feedback linearization.
- That the student should understand the digital implementation of control techniques and basic digital design techniques.
- That the student should be able to use a microcontroller or DSP as a mechatronic system component; and that the student should understand the programming and interfacing issues.
- That the student should be able to apply and combine all these skills to design a mechatronic system.

1st Semester (see profile description for 1st semester of the specialisations in Energy Engineering)

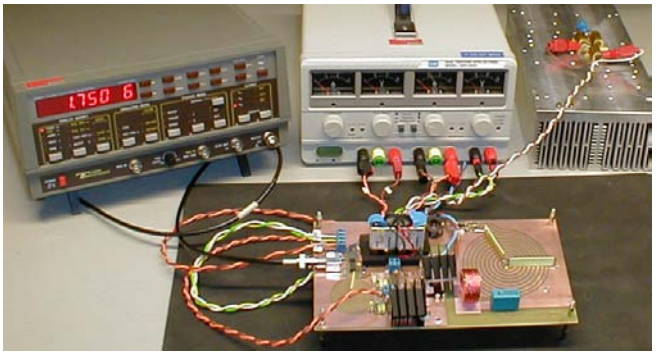
2nd Semester

Project Theme: Advanced control of electrical machines

2nd Semester projects will study a given AC-motor, which is used to drive a mechanical load. To control this motor a frequency converter should be used. The frequency converter should be developed in the project, including designing the power stage of the frequency converter, and an interface-board between the power stage and a DSP-system. Related to this, modulation strategies, and modes of operation for the converter should be analysed as basis for the control strategy of the converter. Based on the developed frequency converter one or more vector control strategies for the motor should be developed enabling this to operate within pre-specified demands for the system. The frequency converter should be build in the laboratory and developed control strategies should be implemented, tested and compared to standard scalar control.

The courses offered on the 2nd semester are:

- Innovation and entrepreneurship
- Optimisation theory
- PLC automation
- Applied digital signal processors
- Power electronics 2
- Modelling and control of robot manipulators
- Advanced control of AC-drives
- Robust feedback control



Project examples:

- Modelling and control of electrically driven servo robot
- Design and control of ”Segway human transporter”

3rd Semester

Project Theme: Intelligent Control of Energy Systems

The project is to study a specified problem, defined in collaboration between a company and the university. In this way the project may address a broad palette of problems in the area of control of energy converting systems. The results of the project may be incorporated into an existing commercial product or system. To continue practising scientific communication, the project result or parts of it should be published in an article written in English which is to be presented at an internal seminar. The project work may optionally be wholly or partly carried out at a company and/or at a foreign university, to strengthen the student's industrial and international relations.

The courses offered on the 3rd semester:

At this semester all the courses are PE courses, and the students must follow a course load corresponding to at least 8 ECTS, of which 2 ECTS are mandatory for all students under the Board of Studies of Energy, the rest is elective and can for instance be courses offered at other specialisations or research intensive packages either within the specialisation or multidisciplinary packages. The elective courses will/or can be changed from year to year.

Mandatory courses:

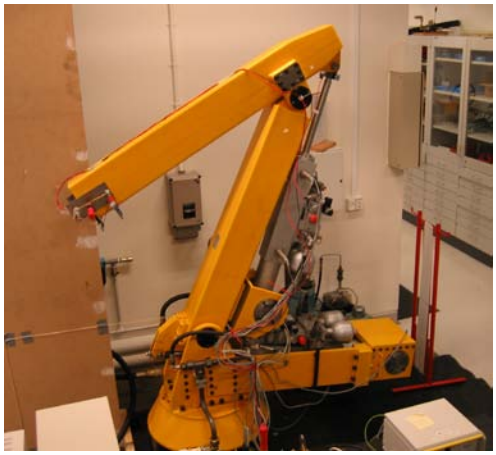
- Stiff systems and differential algebraic equations
- Linear optimal control theory

Courses of which at least 6 ECTS must be chosen could for instance be in the area of:

- Linear electric actuators
- Advanced non-linear control theory
- Programmable logic circuits
- Power electronics in power systems
- Finite element analysis in electromagnetism

Project examples:

- Control of a fuel cell system
- Design and control of an active suspension system for a road vehicle
- Observer based flux vector control of induction machines



4th Semester

Project theme: Master's Thesis

The final project may study new subjects or be an extension of the project work of previous semesters of Mechatronic Control Engineering and may form a cooperation with an industrial partner.

Specific admission requirement

Successful completion of the 1st semester of the M.Sc specialisation in Mechatronic Control Engineering or Introductory Semester under the Board of Studies of Energy, or equivalent.

For further information:

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Study Advisory

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