MF2008 Embedded Control Systems 9.0 credits

Inbyggda styrsystem

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 MF2008 valid from Autumn 2008

Grading scale

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

Education cycle

Second cycle

Main field of study

Specific prerequisites

The course builds upon knowledge and experiences as provided by the Intermediate thesis project in Mechatronics, MF106X or MF107X or MF109X.
The course also requires knowledge and experience corresponding to basic courses in control theory (e.g. Automatic Control, Basic Course, (EL1000), programming (e.g. DD1322 Applied Programming and Computer Science, Part 1, 4 credits, and DD1324 Applied Programming and Computer Science, Part 2, 2 credits) and electronics.
It is advantageous to have taken the following course: Dynamics and Motion Control, MF2007, (4F1907).

Language of instruction

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

Intended learning outcomes

The overall aim of the course is to provide an understanding of the design and implementation of embedded control systems on microcontrollers, with and without real-time operating systems and in distributed computer systems. At the end of this course, the course participants should be able to:

- Provide examples of existing ECS applications and architectures, and describe the special requirements placed in developing such systems.
- Describe and explain the important steps in the design of ECS, the dependencies between control system functionality and the implementation, and the trade-offs that the designer has to deal with.
- Describe and explain the basic concepts of concurrent and real-time programming, including execution strategies, concepts of scheduling theory and Real-time Operating Systems (RTOS).
- Describe and explain the basic concepts of communication protocols and concerns in the design of distributed embedded control systems.
- Apply your knowledge in control theory and software programming in the design and implementation of control algorithms in single processor as well as distributed computer systems, with and without an RTOS.
- Utilize models to describe and analyze system designs (functions, software and hardware) with analysis through simulation and formal analysis.
- Use state-of-the-art tools necessary when developing and analyzing an ECS.

Course contents

The course includes

- Lectures to provide overview and inspiration,
- Tutorials – where new tools and techniques are introduced through detailed instructions,
- Laboratory exercises in which the participants work on a set of exercises to be carried in small groups but to a large extent without direct supervision. The results of the lab exercises should be documented in concise reports and in some cases also demonstrated.
- Classroom exercises where more details are provided compared to the lectures, and where the participants can practice theoretical parts of the course.

Each week of the course focuses on a specific theme. The exercises are modularized according to these themes. The last exercise involves a slightly larger project where the groups have to cooperate in implementing a distributed control systems.

The exercises include the implementation of control systems on a bare processor, with a real-time operating system and in a distributed system. In parts of the exercises, the system designs will be modelled using Simulink/Stateflow and software diagramming techniques (based on selected UML diagrams).

The course is concluded by an individual written exam.

Disposition

Period 2
Lectures 12h
Tutorials 18h
Laboration 30h

Course literature

Course book (for sale at the department) and other course material (lectures, tutorial specifications, RTOS manuals etc.) which are distributed during the course and made available on the course web: http://www.md.kth.se/mmk/gru/mda/MF2008/

Examination

- PRO1 - Project, 6.0 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Approved hand-ins associated with each laboratory exercise. For some of the laboratory exercises, a small oral demonstration may also be required.
Written exam (TEN1; 3 cr)
Lab work (LAB1; 6 cr)

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.