FIL3200 Design of Fault-Tolerant Systems 7.5 credits

Feltoleranta systemkonstruktioner

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 FIL3200 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

All accepted ICT doctoral program students are eligible for this course. Accepted doctoral students from other KTH schools are also eligible for this course.

Language of instruction

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

Intended learning outcomes

The aim of this course is to give doctoral students knowledge necessary to develop dependable systems. As our society becomes more and more reliant on computer, software and embedded systems, dependability of these systems becomes a critical issue. In airplanes, chemical plants or heart pace-makers a system's failure can cost people's lives or environmental disaster. After completing the course, the students should be able to demonstrate the knowledge and skills required to implement and evaluate various fault-tolerant approaches. More specifically, upon completion, students will be able to:

• Describe the state-of-the-art fault-tolerant design techniques. Justify their targeted applications and limitations. Describe how the dependability is assured in an exemplary application.

• Describe dependability means, attributes and impairments. Apply the knowledge to select a suitable set of attributes for a specific application scenario.

• Analyze and critically access the tradeoff among system dependability, performance, and cost. Exemplify some of the trade-offs that are available to designers of electronic and embedded systems.

• Explain the need for different redundancy techniques. Justify pros and contras of different redundancy techniques and select a suitable one for a specific application.

• Apply the knowledge to design a small electronic or embedded system with enhanced dependability. Explain how the dependability is assured in the system.

Course contents

The following is a tentative list of topics to be covered in the course:

• Introduction

  • Definition of fault tolerance

  • Redundancy

  • Applications of fault-tolerance

• Fundamentals of dependability

  • Attributes: reliability, availability, safety

  • Impairments: faults, errors and failures

  • Means: fault prevention, removal and forecasting

• Dependability evaluation

  • Common measures: failures rate, mean time to failure, mean time to repair, etc.

  • Reliability block diagrams

  • Markov processes

• Hardware redundancy

  - Redundancy schemes
  - Evaluation and comparison
  - Applications
- Information redundancy
  - Codes: linear, Hamming, cyclic, unordered, arithmetic, etc.
  - Encoding and decoding techniques
  - Applications
- Time redundancy
- Software fault tolerance
  - Specific features
  - Software fault tolerance techniques: N-version programming, recovery blocks, self-checking software, etc.

Disposition

The course consists of 12 2-hour lectures and 6 1-hour exercises.

Course literature

E. Dubrova, "Fault-Tolerant Design", Springer, 2013, ISBN 978-1-4614-2112-2

Equipment

None

Examination

- EXA1 - Examination, 7.5 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.

In the examination part, the following is included:

- five homework assignments (20%, grade pass/fail)

- a midterm exam (20%, grade pass/fail)

- a final exam (40%, grade pass/fail).

- a research project and its presentation (20%, grade pass/fail)

Other requirements for final grade

To pass, all bullets listed in the examination should be completed.

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.