Diagnosis and Supervision

Programme course

6 credits

Diagnos och övervakning

TSFS06

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Offered for the last time
Spring semester 2024

Replaced by
TSFS22

Main field of study
Electrical Engineering

Course level
Second cycle

Advancement level
A1N

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Mechanical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Automatic Control, Probability

Intended learning outcomes

To give both a theoretical and practical basis for how to design systems that automatically detect and isolate faulty components in technical processes.
After the course is finished, the student shall:

- know why diagnosis systems are used in different industrial application areas.
- know how to analyze which faults in a complex process that need to be supervised to achieve the overall goals.
- from a case description be able to structure the problem and develop principle and architechture for a complete implementation of a diagnosis system.
- given a formal model description be able to choose suitable mathememetical methods to solve the problem.
- know advantages and disadvantages of the different methods that are included in the course.
- be able to apply mathematical tools and methods from a variety of previous courses to solve diagnosis problems.
- be able to value and verify functionality and performance of a complete diagnosis system.
- have a broad theoretical insight in the subject, deep enough to be able to understand and utilize new research results developed by the research community.

Course content

- Introduction: history and overview, practical application examples.
- Principles for model based diagnosis: mathematical modelling of faults, detection and isolation of faults by means of models, consistency relations, analytical redundancy, decisions with structured hypothesis tests.
- Control theory methods: linear and non-linear residual generation, observers and Kalman filters for diagnosis, residual evaluation, adaptive thresholding, statistical methods.
- Logic based AI methods: basic principles, fault isolation algorithms.
- Probability based diagnosis and Bayesian networks.
- Other: fault trees and FMEA, statistical methods/change detection.

Teaching and working methods

The course is organized in lectures, problem solving sessions, and laborations.

Examination

LAB1	Laboratory Work	1.5 credits	U, G
TEN1	Written Examination	4.5 credits	U, 3, 4, 5

See also course homepage for further practical course information.

Grades
Four-grade scale, LiU, U, 3, 4, 5

Department
Institutionen för systemteknik

Director of Studies or equivalent
Johan Löfberg

Examiner
Erik Frisk

Course website and other links

Education components
Preliminary scheduled hours: 54 h
Recommended self-study hours: 106 h

Course literature
Kompendium "Model Based Diagnosis of Technical Processes" av Mattias Nyberg och Erik Frisk med tillhörande lektionskompendium. Utdrag ur boken "Detection of abrupt changes" av Michele Basseville och Igor Nikiforov. Laborations-PM.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.