Modelling and Control of Engines and Drivelines

Programme course

6 credits

Modellering och reglering av motorer och drivlinor

TSFS09

Valid from: 2017 Spring semester

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

Date determined
2017-01-25

Main field of study
Electrical Engineering, Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Mechanical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical 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
Engineering Mechanics, Automatic Control and Matlab

Intended learning outcomes

To understand automotive control systems used for vehicle propulsion, and have the basics for developing future vehicular systems. The student should after the course:

- have knowledge about the systems and components that are important for the propulsion of a road vehicle.
- have knowledge about the operating principles of engines and powertrains.
- be able to explain and analyze the limiting factors for engine performance and control performance.
- be able to describe and implement the most important control loops for air, fuel injection and ignition in todays engine control systems for both gasoline and diesel engines.
- be able to define and explain the emissions from combustion engines and the factors they depend upon.
- be able to design and build control oriented models for an engine and its components as well as a driveline and its components.
- have experience of planning, executing and evaluating engine laboratory experiments.
- have experience of evaluating and assessing model quality based on both system properties and measurement data.
- have experience of planning and synthesizing control algorithms for automotive engines and powertrains.
- be able to define and describe concepts and basic functionality in an engines diagnosis and supervision system.

Course content

- Introduction on engines and thermodynamics.
- Modeling of engines with a controls perspective.
- Engine control including air control, lambda control, ignition control, knock control and turbo control.
- Longitudial vehicle dynamics with air drag and rolling resistance.
- Driveline control including active damping and gear shift control.
- Diagnosis and supervision.

Teaching and working methods

The course is organized in lectures, problem solving and project tasks.
The course runs over the entire autumn semester.

Examination

UPG3	Project assignment	1 credits	U, G
UPG2	Project assignment	2 credits	U, G
UPG1	Project assignment	3 credits	U, G
TEN1	Optional written examination for higher grades	0 credits	U, 3, 4, 5

Pass on the project assignments UPG1-UPG3 gives pass (and grade C). A higher grade (B and A) requires pass on a written exam.
See also course information for further details on examination.

Grades

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

Other information

Supplementary courses: Vehicle Propulsion Systems

Department

Institutionen för systemteknik

Director of Studies or equivalent

Johan Löfberg

Examiner

Lars Eriksson

Course website and other links

Education components

Preliminary scheduled hours: 63 h
Recommended self-study hours: 97 h

Course literature

Additional literature

Books

Lars Eriksson, Lars Nielsen, *Modeling and Control of Engines and Drivelines*

Compendia

Compendia for excerises

Project 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.