Electro Hydraulic Systems

Programme course

6 credits

Elektrohydrauliska system

TMMS13

Valid from: 2017 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2017-01-25

Offered for the last time
Autumn semester 2023

Replaced by
TMMS32 till viss del.

Main field of study
Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Mechanical Engineering, M Sc in Engineering
- Mechanical Engineering, Master's programme

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
Fluid power systems, Automatic Control

Intended learning outcomes

The course gives a deepened understanding for multi-axis motion controlled systems where all aspects of mechatronics like mechanics, electronics, computer technology and software are essential building blocks of its functionality. The mechanical system under study primarily make use of hydraulics and electromechanics as energy transfer technologies, although others may be in the scope. At the end of the course the student should be able to describe, in detail, the different sub-systems in an design in terms of their functionality, integration and control in typical industry applications like cranes, forklifts, construction equipment or workshop automation centres. One should have a good understanding for the mechanical- and control-engineering challenges often found in such systems, in terms of non-ideal phenomena and the mastering thereof by modern computer technology. In parallel getting an deepened and widened insight in the functionality of such systems should also methods, best practise and operation related to the design and verification of found solutions be studied. The general aim is that a student by the given teaching in simulation and embedded computing be able to establish control of a machine in a reliable manor despite its non-linear characteristics.
After the course the student should

- be able to clearly describe the information transfer in industrial networks.
- understand the coupling between motion, force, magnetic flux and electric current in a electromechanical design together with its limitations.
- be able to handle, value and analyse the results of simulations in mathematical models focused on mechatronic systems.
- be able to create simpler programming code to establish motion control or vector references in control systems.
- be able to evaluate and analyse multi-axis systems in different performance measures like positioning errors, energy consumption and stability. Both in general and detail. An also have an understanding for the mechanical life expectancy and maintenance in multi-axis systems by making use of tests and simulations.
- individually present an mechatronic design in both digital media and written report.

After the completion of the course the student should have a good and general understanding of the application of the modern computer technology in studies, design and handling of machinery around us and in industry.

Course content

In contrast to many other courses in this field this one is primarily using simulation technology to provide an understanding for phenomena and challenges in multi-axis systems. Simulation technology is the very basis of modern evaluation of different designs, some of which the student will reflect upon and analyse. Applications typical to modern machine design. Example of this may include parameter drift, backlash, dry friction, bistable systems, dither motion, stiffness fluctuations in actuators and signal delays. Primarily are studies on solenoid and hydraulic valves used as examples of actuating technologies. Load balancing issues in multi-axis single-supply systems is studied. The knowledge about sensors is extended by more quantities in the field of mechanic engineering. A major part of the methods used focus on the overall analysis of the performance of system solutions. Lectures follow the principle trace of the signal chain, from sensor to actuator.

Teaching and working methods

The teaching takes the form of lectures, lessons, design task and laborations. A number of assignments is used in the course where every student individually do an independent related to design and analysis of mechatronic systems. Lectures and lessons are based on text book literature and some research papers. If suitable, some of the content is adjusted to be aligned with the project work in TMPM01. Elaborative work will require a good deal of preparation and initiative from the student. Computer class work run smoothly with some practical experience of computers and some knowledge about script programming. A number of computer tools/software will be used in the course such like 3D CAD, MATLAB/Simulink and text editors.

Examination

LAB1	Laboratory work	2 credits	U, G
UPG2	Assignments	1 credits	U, G
UPG1	Individual written assignment	3 credits	U, 3, 4, 5

Grades

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

Other information

Supplementary courses: The course is scheduled in close relation to TMPM01, project work in mechanical engineering, where many of the efforts in this course find their application.

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent
Peter Hallberg

Examiner
Magnus Sethson

Course website and other links

Education components
Preliminary scheduled hours: 48 h
Recommended self-study hours: 112 h

Course literature

Additional literature

Books

Clarence W. de Silva, CRC Press, *Mechatronics, An Integrated Approach*
ISBN: 0-84931274-4
William Bolton, Pearson, *Mechatronics, Electronic control systems in Mechanical and Electrical Engineering* 6
ISBN: 978-1-292-07668-3

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.