SYLLABUS

Spacecraft Control 7.5 credits R7026R

Rymdfarkostkontroll

Course syllabus admitted: Autumn 2023 Sp 1 - Present

DECISION DATE
2022-08-22

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LULEÅ TEKNISKA UNIVERSITET

Spacecraft Control 7.5 credits R7026R

Rymdfarkostkontroll

Second cycle, R7026R

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Rymdteknik	Space Technology

Main field of study

Space Technology

Entry requirements

Basic courses in linear algebra, calculus, and ordinary differential equations and partial differentials e.g M0055M Functions of Several Variables or equivalent.

Basic knowledge of the Laplace transform, e.g M0046M Mathematics Space or equivalent.

R7025R Orbit and Attitude Dynamics.

R0005E Measurement and feedback control.

Knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

After successfully finishing the course, the student shall be able to:
• Explain and model the spacecraft attitude dynamics and control.
• Explain and model the passive and active attitude control systems for applications on attitude stabilization and attitude maneuver control by using classical control theory as well as the attitude estimation based on Kalman filtering technique.
• Perform analytical and computer-based calculation of attitude dynamics and control and estimation.
• Write report of analysis and calculations.
• Assess and report on the feasibility of different attitude control systems in different situations

Contents

The course covers the essentials of attitude dynamics and control, Euler angles, Euler equations and quaternions, Torque free motion, Spin-stabilization, Stabilization with momentum and reaction wheels, Dual-spin, Gyroscope control and gravity gradient stabilization, Active attitude control, Automatic feedback control, Nutation and libration damping, Analysis of linear systems, Laplace transforms and transfer functions. introduction of the Kalman filter for attitude estimation. MATLAB simulations.

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
Lectures covering the contents, individual and group assignments, and practical using mathematical and engineering tools for modeling and design.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
Written examination composed by questions involving theory and mathematical problems. A number of hand in assignments along the course and, at the end of the course, a project assignment performed in group with oral presentation.
The final grade 5, 4, 3, and U (Fail) given for the course reflects the results obtained in the various components of the course.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

This course cannot be part of the degree together with the course R7016R.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0003	Assignment report	G U 3 4 5	1	Mandatory	A21	
0004	Project work	G U 3 4 5	2	Mandatory	A21	
0005	Written exam	G U 3 4 5	4.5	Mandatory	A21	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Jonny Johansson, HUL SRT 2022-08-22

Syllabus established

by Jonny Johansson, HUL SRT 2019-02-15