SYLLABUS

Orbit and Attitude Dynamics 7.5 credits R7025R

Ban- och attityddynamik

Course syllabus admitted: Autumn 2023 Sp 1 - Present

DECISION DATE
2021-06-16

Luleå University of Technology 971 87 Luleå, Sweden
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LULEÅ TEKNISKA UNIVERSITET

Orbit and Attitude Dynamics 7.5 credits R7025R

Ban- och attityddynamik

Second cycle, R7025R

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
In-depth studies in mechanics involving Kepler laws with 3-dim applications e.g F0055T Mekanik II Ry or equivalent.

Good knowledge in English, equivalent to English 6

Selection

The selection is based on 30-285 credits

Course Aim

The student shall acquire ability to understand and predict how spacecraft orbit evolves.
The student shall acquire familiarity with concepts and methods used within the field spaceflight dynamics. These requirements are shown by the student's ability to account for this.

The student shall acquire capability of performing analytical and computer based calculation of orbits.

The student shall be able to value different orbits efficiency concerning time consumption and fuel consumption. This is shown by comparative calculations.

The student shall have ability to understand and predict how spacecraft attitude evolves. The student should be familiar with and be able to describe concepts and methods used within the field spaceflight attitude dynamics.

The student shall have capability of performing analytical and computer based calculation of attitude dynamics.

The student shall be able to assess and report on the feasibility of different attitude control systems in different situations.

The student shall have skills in writing report of analysis and calculations.

Contents

Kepler’s equations and Kepler’s problem. Classical orbital elements. Time and reference systems. Transformation between different reference systems.
Undisturbed elliptic, hyperbolic, and parabolic orbit,
Orbital maneuvers and transfers,
Orbit determination,
Orbit perturbations.

Kinematics and dynamics for rigid body motion.
Euler angles, Euler equations and quaternions.
Torque free motion, spin stabilization, dual spin, gyroscopic control and gravity gradiant stabilization,

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.
Students solve certain exercises with computer aids.

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 and hand in assignments. In order to pass the course it is required that all examinations and obligatory tasks are completely satisfactory. 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 R7015R or the course R7016R.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Assignment report	U G#	1.5	Mandatory	A19	
0003	Written exam	G U 3 4 5	6	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 2021-06-16

Syllabus established

by Jonny Johansson, HUL SRT 2019-02-15