Mechanics, second course

Programme course

6 credits

Mekanik, fortsättningskurs

TMME19

Valid from: 2017 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2017-01-25

Main field of study
Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Design and Product Development
- Mechanical 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
Calculus in one and several variables including differential equations, vector algebra, matrix algebra, statics, particle dynamics, basic rigid body dynamics.

Intended learning outcomes
To develop the knowledge of rigid body dynamics to a level where problems where the motion as a function of time of a rigid body in three dimensions can be analyzed and solved using a computer. After the course, the student should be able to:

- Apply Coriolis equation to formulate the equations of motion and rotational motion in an accelerating and rotating coordinate system.
- Apply some parameterization of the coordinate transformation matrix to transform vectors between coordinate systems and to write relations between orientation and angular velocity for a rigid body.
- Formulate a system of first order differential equations for the motion of a rigid body in a rotating and accelerating coordinate system.
- Implement such differential equations to compute the motion of a rigid body with specified forces and moments on a computer.

Course content

Newton's equations of motion, the concept of an inertial system, coordinate transformations, Coriolis' equation, the moment equation, moment of momentum, the inertia tensor, differential-algebraic systems, the Euler angles, the Euler parameters, the strap-down equations, Newton's bucket, gravitational and inertial mass.

Teaching and working methods

The course is given as a series of lectures and computer sessions. The examination is in the form of individual computer assignments, using Matlab, submitted as written reports.

Examination

UPG1	Exercise	6 credits	U, 3, 4, 5

Grades

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

Other information

Supplementary courses: Flight Mechanics, Multi Body Dynamics and Robotics, Road Vehicle Dynamics

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Peter Schmidt

Examiner

Lars Johansson

Course website and other links

Education components

Preliminary scheduled hours: 58 h
Recommended self-study hours: 102 h

Course literature

Additional literature

Books

Wiesel, W.E, (2010) *Spaceflight Dynamics* 3rd edition

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.