

## **Course outline for TMME19 Mechanics, second course, VT2 2019**

### **Lectures and problem seminars**

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### **Computer assignments**

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### **Course literature**

Wiesel, E.W., Spaceflight Dynamics, 3ed Aphelion 2010, chapters 1, 4, 5, 6. Earlier editions can also be used.

It is possible to make do with meticulous lecture notes.

### **Examination**

The examination consists of computer assignments in Matlab. There are five assignments, each graded with a maximum score of four points. For grades 3, 4 and 5 a total score of 9, 13 and 17 points, respectively, are required. The assignments are performed individually. The deadline for the computer assignment reports is 2019-06-13. Assignments handed in after this date will be taken into account if needed to reach grade 3, but will not be counted towards grades 4 or 5. Assignments handed in by 2019-05-20 will be returned marked (once) while there are still a few days left before the deadline to prepare a revised version. *Read the instructions for the reports last in this course outline before handing in the reports.*

## Programme for lectures and problem seminars

### Content

Lect1	Newton's equations of motion. Inertial systems.
Lect2	Coriolis' equation.
Lect3	Particle dynamics in rotating systems.
Lect4	Coriolis' equation, again.
Prob1	5, 1.
Prob2	Individual work: 7, 6, 2, 3, 4.
Lect5	Eqs. of motion for particle systems and rigid bodies.
Lect6	Moment of momentum.
Lect7	The inertia tensor.
Prob3	19, 18.
Prob4	Individual work: 14, 20, 17, 24, 15.
Lect8	Euler's equations. Eqs. of motion with constraints.
Lect9	The euler angles.
Lect10	The euler parameters.
Prob5	9, 10.
Prob6	22.
Prob7	Individual work: 8, 11, 23, 25.
Lect11	Stability of rotation about principle axis of inertia.
Lect12	Gravitational and inertial mass. Newton's argument for absolute space.

### Instructions for reporting the computer assignments

The computer assignments are reported in writing, *printed on paper*. The assignments are performed individually. It is permissible to discuss the assignments and to show parts of solutions in that context, but *copying of Matlab code or sections of reports is not allowed*. Further, it is not allowed to possess copies of other students reports or Matlab code either electronically or on paper, or to supply this to another student; this also means that you hand in and pick up your assignments yourself, not with the help of a friend. The reports shall contain:

- Name and complete civic registration number (10 digits) of the student (sometimes called p-number among exchange students).
- The number of the dataset used.
- A short description of the system to be analyzed, with a drawing.
- Answers to all the questions appearing under the headings "Assignment I:a" etc. and any plots requested.
- A complete set of Matlab-files. Choose the most complete version of your code for each assignment. This should be files with everything required to run a simulation, not excerpts to show implementation of specific details.
- It must be shown explicitly what data is used in what way. All calculations must be shown explicitly so that correctness and relation to your dataset can be assessed at a glance.
- When derivations are requested, quantities must be defined in figures. For derivations of equations of motion, free body diagrams must be included.
- The system (ode or dae) actually implemented must be given in the report and be in the order actually implemented, written in a single frame containing *only* the ode or dae implemented and *nothing* else, on human readable form (not Matlab code or pseudocode).
- The report must contain sufficient text and illustrations such that it is possible to understand without ever having seen the lab-PM.
- No copies of text, illustrations, equations or code from any other document is allowed (unless it is a document you have created yourself). As an exception, copies of illustrations in the lab-PM defining the problem at hand are accepted.