Course outline for TMME 50 Flight Mechanics, HT2 2019/20

Lectures

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Computer assignments

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Computer lab groups

Scheduled sessions for help with the computer assignments are called Lab (or Laboration) in the web-schedule. Due to the large number of students, the first three sessions are split into groups. Those with family names beginning with A-J are in group A, those with names on K-Ö are in group B. You might have to search specifically for the course code (TMME50) to get all information from the web-schedule.

Course literature

Nelson, R.C., Flight Stability and Automatic Control, 2ed, McGraw-Hill 1998 (the first edition is also OK).

Relative importance of the course contents

Sec. in Nelson: 1C, 2C, 3A, 4A, 5B, 8B
where A=highest priority, B=high priority, C=low priority.

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 is 2020-01-18 for assignments 1, 2, 3 and 4. 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 very early, 2019-12-02 for assignments 1 and 2 and 2019-12-12 for assignments 3 and 4, will be returned marked (once) while there are still a few days left to prepare a revised version before the deadline. There is no deadline for the fifth assignment; it can be submitted also after a passing grade has been reported. *The instructions for the reports for the current year, page 3 in this course outline, shall be included in every report. Reports without this page are graded with zero points and returned without being marked.*

Programme for the lectures

Italics denotes overlap with Rigid Body Dynamics, Second Course. Lectures 5 and 6 gives a review of some introductory concepts of automatic control.

Contents

Instructions 2019 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:

- *A copy of this page with instructions.*
- Name and complete (10 digits) civic registration number of the student (sometimes called p-number among exchange students).
- *Which aeroplane and which reference condition* that has been used. Specify the number of the column on the data sheet that has been used.
- Answers to all the questions appearing under the headings "Assignment I:a" etc. and all plots specified.
- A complete set of Matlab files for each computer assignment. Choose the most complete set, such as the one for part I:c in assignment I. In assignment II, also also include root loci and a graphic representation of your Simulink model for the final version of your model with all numerical values shown explicitly.
- The ODE system implemented in assignments I, III, IV and V must be given in the report in the order actually implemented and written in a *single* frame containing *all* the equations of the ODE and *nothing* else.

Further, note:

- With the exeption of flying qualities tables, illustrations from the lab-PM defining the problem and this page of instructions, no copying of text, figures, equations or code from another document is allowed (unless it is a document you have created yourself).
- It must be clear what data has been used in what way. Data is converted from American to SI units, and this should be done in a way that can be followed in detail either in the text of the report or in the Matlab files, so that misstakes can be found without making any computations.
- If you don't have access to the textbook, the flying qualities characterization of computer assignment IV part b is done using the tables of sections 3.2.1.2, 3.2.2.1.2, 3.3.1.1, 3.3.1.2 and 3.3.1.3 in MIL-F-8785C. First, the type of aeroplane according to section 1.3 and the flight condition according to section 1.4 must be decided. MIL-F-8785C is found as:

- Use the simulation time given in the assignments. For a small number of datasets it is necessary to use a longer simulation time than 100 s in order to to see a full phugoid period, but the time should never be shorter than the time given and never longer than 400 s.
- It must be possible to understand the report also for a reader that does not have the lab-PM. Thus, there must be a brief introduction to each report and brief explanations of the purpose of each calculation.

Missprints in chapter 3 in Nelson, R.C., Flight Stability and Automatic Control, 2ed, 1998

Page

97	The coordinate system Fixed frame"in fig. 3.1 should be: $x_f y_f z_f$.
100	Eq. 3.18 should be: $\ldots q\mathbf{j} \ldots y\mathbf{j} \ldots$.
102	Ignore fig 3.3.
102	Eq. 3.30, 3×3-matrix right hand side, row 3 column 2, should be: $S_\phi C_\theta$.
105	Tab. 3.1, fifth equation (pitch moment equation), second term right hand side, should be: $rp(I_x - I_z)$.
105	Tab. 3.1, last equation, column matrix left hand side, second element, should be: $\frac{dy}{dt}$.
105	Tab. 3.1, last equation 3×3-matrix right hand side, row 1 column 3, should be: $C_\phi S_\theta C_\psi + S_\phi S_\psi$.
109	Eq. 3.51 and 3.52: non-consistent definitions of C_{xu}. Cancel eq. 3.52. Also cancel the second of eqs.3.58 on page. 111.
111	Above eq. 3.63 should be: lift coefficient.
115	Fig. 3.9 roll angular velocity p is drawn in the wrong direction.
119	Fig. 3.10 the sideslip angle should be: $\Delta\beta$.