

31910 – Introduction to Control

Lecturer: Professor Eduard Eitelberg

Credits: 3.5 points

Hours: 3 lectures per week, 1 tutorial per week

Grade Composition: 100% – final exam; requirement for passing the course: 55%

Prerequisites: Modelling and Simulation OR for a while longer (31315 Introduction to Electrical Engineering, 11122 Partial Differential Equations and Fourier Series)

Course Description:

The subject matter of this course encompasses the fundamental principles and relevant techniques for designing continuous-time SISO LTI control systems that satisfy practically relevant system performance specifications.

Much of **the learning** takes place in a **process** where small groups of students solve design problems in class under supervision. Both, lectures and tutorials, will be used for this purpose. Students are required to carry copies of *EdS Charts* and drawing implements to all lectures/tutorials, starting in the second week of the semester.

Course Content:

I Introduction and foundations

II Feedback control fundamentals

1. 2DOF feedback control and algebraic examples
2. The system sensitivity function and absolute tracking error
3. Effect of high gain at plant output and input

III Loop transfer function fundamentals

1. Nyquist criterion for closed loop stability
2. The sensitivity chart
3. Dynamic examples and conditional stability
4. Transfer function phase and gain relationships
5. Stability with non-minimum phase-lag loops
6. Loop design perspective

IV Linear SISO systems

1. Quantitative design options
2. Disturbance regulation with certain plants
3. Disturbance regulation with uncertain plants

V Tracking with uncertain plants or other material (to the extent that time permits)

1. Transfer sensitivity and relative tracking error (derivation)
2. Critical gain tuning, anti-windup, etc?

Bibliography:

1. Ed. Eitelberg's Control Engineering. NOYB Press, Durban, 2000. *(There are 5 copies in the College library and students are permitted by me (the copyright holder) to make copies of the relevant pages for the purposes of this course only. The ORT Braude Students Union has my permission to print, bind and sell the first four chapters of this book at cost to the students of this course.)*

Learning Outcome:

The student is able to design continuous-time SISO LTI control systems that satisfy practically relevant system performance specifications in frequency domain.

Assessment (in English): (1) Formative (un-announced) assessment will take place during the semester. (2) Summative assessment is on the basis of the final examination only and that will yield the course mark. All assessment is open-book. However, computers and programmable calculators are not allowed.

Consultation hour: Monday 12h30 – 13h30, in EM 403.

Note: This is not a contract. Written and verbal instructions may override any part of this course outline.

Last update: August 2019.

A handwritten signature in blue ink, appearing to be 'A. J.', is located below the 'Last update' text.