SF2842 Geometric Control Theory 7.5 credits

Geometrisk styrteori

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for SF2842 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mathematics

Specific prerequisites

SF2832 Mathematical systems theory or
EL1000 (or EL1110) Automatic Control, General Course.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

This is an advanced course in mathematical systems theory. With the geometric control theory in focus, this course deepens and broadens knowledge and introduces new concepts in the subject. The course aims at that the student can use the geometric approach to treat basic control design and analysis problems for both linear systems and some nonlinear systems. The knowledge and skill acquired in this course also help enhance the student's ability for abstracting engineering problems.

The **overall goal** of the course is that the student understands and appreciates the theory and various tools in the geometric approach to systems and control; in particular the student should be able to use the underlying methodologies in practical applications.

Measurable goals

After having finished the course the student should be able to do the following:

- Reinterpret basic control properties such as Controllability and Observability for linear systems as the property of certain invariant subspace.
- Understand the geometric interpretation of transmission zeros and zero dynamics.
- Compute invariant subspaces and various controlled invariant subspaces.
- Apply different algorithms to solve control problems such as DDP, non-interacting control, tracking and output regulation.
- Explain how the steady state output response is shaped by the input signal.
- Solve some basic control problems for nonlinear systems that do not have a controllable linearized system.

For the highest grade the student should be in addition able to

- Explain how the above results and methods relate and build on each other.
- Explain the mathematical foundation and control implication of the results and algorithms studied in the course.
- Solve simple but realistic control problems that require the synthesis of different design algorithms.

Course contents

Introduction and motivation, Invariance and controlled invariance, Zeros, Zero dynamics and system inversion, Tracking and non-interacting control, Disturbance decoupling, Internal model principle, Spectral factorization, Nonlinear systems, Geometric control of robotic systems.

Course literature

Geometric Control Theory, lecture notes by Hu and Lindquist.

Examination

- HEM1 - Exercises, 7.5 credits, grading scale: P, F
- TEN1 - Examination, 0.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Homework assignments.
A written examination for higher grade.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.