EQ2820 Matrix Algebra, Accelerated Program 7.5 credits

Matrisalgebra, forskarförberedande

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

Establishment

Course syllabus for EQ2820 valid from Spring 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

For single course students: 180 credits and documented proficiency in English B or equivalent

Language of instruction

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

Intended learning outcomes

The course is given every second year and is suitable as a first postgraduate (Ph.D) course or as an advanced course in the final year of the M.Sc. program (e.g., for students considering to join the PhD program).

We will refresh and extend the basic knowledge in linear algebra from previous courses in the undergraduate program. Matrix algebra is of fundamental importance for scientists and engineers in many disciplines. In this course we will focus on topics that are of particular interest in communications, signal processing and automatic control.

The course requires a large amount of self study and homework problems will be handed out every week and will be due the following week. It assumes some familiarity with basic concepts from linear algebra (as can be expected by good knowledge from undergraduate studies).

Learning outcomes:

After the course, each student is expected to be able to:

- Show a good working knowledge of some fundamental tools (specified by the course content) in matrix algebra.
- Use the acquired knowledge to more easily apprehend research papers in engineering.
- Identify research problems in which matrix algebra tools may be powerful.
- Apply the knowledge to solve the identified matrix algebra problems.
- Combine several sub problems and solutions to solve more complex problems.

Course contents

Main contents:

1. Review of vector spaces, inner product, determinants, rank

2. Eigenvalues, eigenvectors characteristic polynomial

3. Unitary equivalence QR-factorization

4. Canonical forms Jordan form, polynomials and matrices

5. Hermitian and symmetric matrices Variational characterization of eigenvalues, simultaneous diagonalization

6. Norms for vectors and matrices

7. Location and perturbation of eigenvalues

8. Positive definite matrices. Singular value decomposition

9. Nonnegative matrices, positive matrices, stochastic matrices

10. Stable matrices; Lyapunovs theorem

11. Matrix equations and the Kronecker product, Hadamard product

12. Matrices and functions square roots, differentiation

Course literature

Will be reported on the course homepage four weeks before start.

Previously we have used the books “Matrix Analysis” and “Topics in Matrix Analysis” by R.A. Horn and C. R. Johnson.

Examination

- TEN1 - Examination, 7.5 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

Weekly homework assignments (TEN1, 7.5 ECTS credits, grading A-F)
Written exam if homework not solved satisfactorily.

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.