FEM3220 Matrix Algebra 10.0 credits

Matrisalgebra

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

Establishment

Course syllabus for FEM3220 valid from Spring 2012

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Doctoral students at the School of Electrical Engineering. External participation by admission of the examiner.

Language of instruction

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

Intended learning outcomes

After the course, each student is expected 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.

· Show improved skills in problem solving and proof writing as well as in critical assessment of proofs and solutions.

· Show improved skills in oral presentation of technical contents.

Course 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

Additional topics selected for the student presentations

Disposition

There will be 9 lectures and 9 sets of written homework assignments. A peer review grading procedure will be applied. At the end of the course the participants will be asked to present a relevant topic extending the curriculum of the course.

Course literature

The required course literature will be stated on the course homepage four weeks before course start. Previously we have used the books “Matrix Analysis” and “Topics in Matrix Analysis” by R.A. Horn and C. R. Johnson.

Examination

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

- Individual solutions to weekly written homework assignments, 80% of max score (Written exam if homework not satisfactorily solved)
- Peer-review grading of assigned problem sets
- Presentation of assigned topic and actively participating during other students presentations

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.