

DMA-SAP-431 APPLIED LINEAR ALGEBRA

SEMESTER: Spring
CREDITS: 6 ECTS (4 hrs. per week)
LANGUAGE: English
DEGREES: SAPIENS program

Course overview

This is a foundation course in linear algebra. By its nature, linear algebra has many applications in abstract mathematics and in real life. We will present theoretical concepts with their motivation and applications.

The class time will be devoted to lectures where the students should gain an understanding of basic concepts and methods, realize connections between various parts of linear algebra and eventually build a global picture of linear algebra. The material we cover is also meant as an introduction to a more abstract level of learning or using mathematics.

Prerequisites

Basic knowledge of Calculus and High School Algebra.

Course contents and methodology

Methodology

Lecture, solving calculation problems during exercises.

Contents

- I. LINEAR SYSTEMS (Chapter 1 in [1]).
Matrices, Vectors and Gauss-Jordan elimination. On the solutions of Linear Systems.
Matrix Algebra.
- II. VECTOR SPACES (Chapters 3 and 4 in [1]).
Vector Spaces and Subspaces. Linear Independence, Basis and Dimension. Coordinates.

III. LINEAR TRANSFORMATIONS (Chapters 3 and 4 in [1]).

Linear Transformations and Isomorphisms. The Matrix of a Linear Transformation.

IV. ORTHOGONALITY (Chapter 5 in [1]).

Orthogonal Vectors and Subspaces. Projections and Least Squares. Orthogonal Bases and Gram-Schmidt.

V. EIGENVALUES AND EIGENVECTORS (Chapter 7 in [1]).

Dynamical Systems and Eigenvectors: An introductory example. Diagonalization of a Matrix. Complex Matrices. Similarity Transformations.

VI. POSITIVE DEFINITE MATRICES (Chapter 8 in [1]).

Minima, Maxima and Saddle Points. Quadratic Forms. Singular Value Decomposition.

Textbooks

[1] *Linear Algebra with Applications*, 4th Edition, Otto Bretscher. (basic bibliography)

[2] *Introduction to Linear Algebra*, 4th Edition, Gilbert Strang. (additional bibliography)

Grading

The overall grade will be obtained as follows:

- Three midterms (15%, 25% and 35% respectively)
- Homework (25%)

The students who fail or want to improve their grades will do a final exam the last day of the course.

The exams are all closed notebook, closed textbook and no calculator. The course will not be graded on a curve, i.e., there is no bound on the numbers A's, B's, C's, etc.