

Linear algebra

Introducing

Description

Resolution of linear systems

1. Gauss elimination. Manipulation of rows and columns. Matrix interpretation
2. Existence criterion: rank, kernel, strictly dominant diagonals
3. LU factorization

Prehilbertian and Euclidian spaces

1. Scalar product: examples, properties
2. Orthogonality: orthogonal basis, projections
3. Mean Square solution of linear systems, QR factorization

Reduction of endomorphisms

1. Eigen-elements: eigenvalues, eigenfunctions, characteristic polynom
2. Diagonalisation, trigonalisation, Cayley-Hamilton
3. Applications: linear differential systems and recurrences, spectrum computation

Endomorphisms of Euclidian spaces

1. Isometries, Orthogonal Matrices
2. Adjoint, Self-adjoint endomorphisms, diagonalization
3. Singular Value Decomposition (data visualization)

Hermitian spaces

1. Hermitian product, Orthogonality
2. Endomorphisms of Hermitian spaces: adjoint, reduction.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- Knowing main factorization results on matrices: LU, QR, SVD
- Main results on diagonalization and trigonalization
- Orthogonality
- Adjoint of a matrix, self-adjoint matrices and spectral theorem, Isometries

The student will be able to:

- Solve linear system with Gauss elimination and give a matrix interpretation
- Compute orthogonal basis or orthogonal projection on a subspace
- Provide a matricial interpretation of the main classes of Euclidian endomorphisms
- Diagonalize or trigonalize matrices
- Solve numerically a linear system in a mean square sense. Apply numerical SVD.

Necessary prerequisites

Basic linear algebra: vector spaces, subspaces, linear application, matrix, Kernel and Image of a linear application

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes :

examen écrit, oral, compte-rendu, rapport écrit,
évaluation par les pairs...

Practical info

Location(s)

 Toulouse