

Mathematical tools 2

Introducing

Description

Linear Algebra

Eigen-elements: eigenvalues, eigenvectors, characteristic polynomial

Diagonalization

Applications

Euclidean Spaces

Scalar product: examples, properties

Orthogonality: Pythagoras theorem, orthogonal bases, orthogonal projection

Bilinear Algebra

Bilinearity

Symmetric positive definite matrices: definition, properties, characterization

Ordinary Differential Equations (ODEs) – Linear

Examples, general framework of affine ODEs

Special case of linear ODEs with constant coefficients

Multivariable Functions

Notion of differential for multivariable functions

First- and second-order optimality conditions

Multiple integrals

Numerical Analysis

Numerical resolution of ODEs

Interpolation

Numerical integration

Least squares method

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Knowledge of the main results in matrix reduction

Understanding the concept of scalar product and orthogonality

Basic notions of bilinear algebra

The concept of the differential of a multivariable function and partial derivatives

Solving linear differential equations with or without a forcing term

Calculations of integrals of functions of several variables

Finding extrema of a function

The least squares method

Numerical interpolation

Numerical integration

Numerical resolution of differential equations

List of competencies:

Code Competency

1_1 Master mathematical concepts and computational tools relevant to engineering

1_2 Develop rigorous scientific reasoning and the capacity for abstraction

2_1 Master the fundamental tools of the mathematical engineer

(Competency matrix of CTI, 2019)

Necessary prerequisites

Linear algebra and first-year analysis, programming in Python.

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