3rd YEAR MIC_SEMESTER 6_ ORIENTATION MA

Practical info

Location(s)

Toulouse

Modelling

ECTS
7 crédits

Hourly volume
64h

Introducing

Objectives

At the end of this module, the student should have understood and be able to explain the following notions for each subject :

¿ Mechanics : understanding the behaviour of a moving solid subjected to external actions.

¿ Introduction to numerical modelling : fundamentals of the finite difference method (order of a scheme, stability, discrete maximum principle, convergence); formal definition of the Brownian motion and principles of the Monte-Carlo method for parabolic PDEs; the use of PDE for modelling problems with continuous variables.

¿ Modelling project : how to model mathematically and numerically a given industrial ¿ engineering - scientific problem.

The student should have the following skills :

¿ Mechanics : to parameterize a moving solid in the space; To apply the Newton¿s laws to moving solids.

¿ Introduction to numerical modelling : to model simple problems using PDEs; to analyse stability and consistency of a finite difference scheme; to program with Python a finite difference scheme or the Monte-Carlo method for solving a linear parabolic PDE; to analyse numerical results and identify / explain numerical errors.

¿ Modelling project : to develop a solution to the initial engineering problem by employing the different mathematical and numerical tools studied in his other courses.

Necessary prerequisites

Required knowledge for each subject :

¿ Mechanics : mathematics (derivation, intégration, PDE), atomic structure , point mass mechanics.

¿ Introduction to numerical modelling : basis of probability theory, of integral and differential calculus, and of numerical analysis.

¿ Modelling project : numerical analysis, matrix computations, optimisation, ODE, PDE, geometrical modelling, probabilities, statistics, programming (Python).

Practical info

Location(s)

Toulouse

Martix computation and geometry

ECTS
4 crédits

Hourly volume
51h

Introducing

Objectives

Objectives:
At the end of this module, the student will have understood and be able to explain (main concepts):
- QR factorization: the Gram-Schmidt and Householder methods
- Singular value decomposition
- Application to the least squares problem.
- Piecewise functions, Ck continuity, natural cubic splines and their local and global representations, basis of B-Splines, B-Spline curves and their control points.
- The extension to NURBS curves and to surface modelling in CAD.

The student will be able to:
- Determine the most efficient method to solve a least squares problem by identifying the characteristics of the problem.
- Determine and compute the interpolating spline, the smoothing spline, and the least squares spline of n given points.
- Build a B-Spline curve of n given points (analytically and by a subdivision algorithm (de Casteljau, de Boor))
- Apprehend, modify a NURBS curve.

Necessary prerequisites

Necessary knowledge:

Linear algebra, resolution of linear systems, use of matlab or python.

Practical info

Location(s)

Toulouse

Statistics

ECTS
6 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Object oriented coding

ECTS
3 crédits

Hourly volume
42h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) the concepts of the object programming. The student will be able to create simple programs in object language.

Practical info

Location(s)

Toulouse