Numerical methods

Lecturer
Artem NAPOV (Coordinator)

Course mnemonic
MATH-H401

Language(s) of instruction
English

Course period
First term

Campus
Solbosch

Course content

Numerical Methods for PDEs:Finite difference discretization of partial differential equations (stationary and time dependent problems); solution of very large linear systems (direct and iterative methods, including multigrid methods); rounding errors, numerical stability and control of the accuracy.

Monte Carlo Methods: Relevance of Monte Carlo simulation. Estimation of definite integrals. Convergence and accuracy. Variance-reduction methods. Application to particle transport problems and to system reliability

Project: Dévelopment of an individual project.

Objectives (and/or specific learning outcomes)

Numerical Methods for PDEs: Learn modern techniques to numerically solve partial differential equations.

Monte Carlo Methods: Introduction to Monte Carlo simulation, to the statistical convergence of the algorithms, to variance-reduction techniques...

Project:Learn to solve a numerical problem with a program written in an adapted langage (C or Fortran).

Teaching method and learning activities

Numerical Methods for PDEs: Commented slides + live questions & answers and exercise sessions.

Monte Carlo Methods: ex-cathedra and collaborative lectures; exercises

Project:Learning by projet.

Contribution to the teaching profile

Solution of technical and scientific problems:
- by using the knowledge acquired during the course (PE1);
- by using rigorous and creative approaches (PE2);

Preparation of a technical report followed by an oral defense of the project (PE5)

References, bibliography and recommended reading

cf. Université Virtuelle

Course notes

Podcast and Université virtuelle

Other information

Place(s) of teaching

Solbosch

Contact(s)

Solbosch, Build. D, Level 3, entrance B:

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Evaluation method(s)

Other

Evaluation method(s) (additional information)

Numerical Methods for PDEs: Written exam with documents.

Monte-Carlo Methods: Oral exam.

Project: Project evaluation based on the report, the software code, and the oral defense.

Determination of the mark (including the weighting of partial marks)

Standard rule: 2/5 mark exam *Numerical Methods for PDEs* + 1/5 mark exam *Monte Carlo Methods* + 2/5 mark *Project*.

To benefit from the standard rule, either the three partial marks must be greater than or equal to 10, or two of them must be greater than or equal to 12 and the last equal to 9. In any other case, the minimum partial mark becomes the final one. Partial marks greater than or equal to 10 remain acquired for subsequent sessions.

Main language(s) of evaluation

English

Other language(s) of evaluation, if applicable

French

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRPH | Master of science in Physical Engineering | finalité Professional/unit 1

Programmes proposing this course at the faculty of Sciences

MA-STAT | Master in Statistics : General | finalité Research General/ unit 2