

MATH-251(d) **Numerical analysis**

Antolin Sanchez Pablo

Cursus	Sem.	Type
Electrical and Electronical Engineering	BA4	Obl.
HES - EL	E	Obl.
HES - GM	E	Obl.
Materials Science and Engineering	BA4	Obl.
Mechanical engineering	BA4	Obl.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course offers an introduction to numerical methods for the solution of mathematical problems as: solution of systems of linear and non-linear equations, functions approximation, integration and differentiation and solution of differential equations.

Content

- Iterative methods for solving non-linear equations.
- Polynomial approximation: interpolation and least square methods.
- Numerical integration and differentiation.
- Solution of systems of linear equations: direct and iterative methods.
- Numerical approximation of differential equations.
- Introduction to MATLAB software.

Learning Prerequisites**Required courses**

Analysis, Linear Algebra

Learning Outcomes

- Choose a numerical method for solving a specific problem.
- Interpret obtained numerical results from a theoretical perspective.
- Estimate numerical errors.
- Prove theoretical properties of numerical methods.
- Implement numerical algorithms.
- Apply numerical algorithms to specific problems.
- Describe numerical methods.
- State theoretical properties of mathematical problems and numerical methods.

Transversal skills

- Use a work methodology appropriate to the task.

- Use both general and domain specific IT resources and tools
- Access and evaluate appropriate sources of information.

Teaching methods

Ex cathedra lectures; exercises with computer using MATLAB software. For both, the theory and exercises lectures a videoconference system will be used.

Expected student activities

- Class attendance.
- Solution of proposed exercises.
- Solution of problems using MATLAB.

Assessment methods

Written exam at the end of the semester.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

Yes

Bibliography

In English:

- Lecturer notes.
- A. Quarteroni et F. Saleri et P. Gervasio: « Scientific Computing with MATLAB and OCTAVE », Springer, 2014, ISBN 978-3-642-45367-0.
- A. Quarteroni, R. Sacco et F. Saleri : « Numerical Mathematics », Springer, 2007, ISBN 978-3-540-49809-4.

In French:

- Lecture notes.
- A. Quarteroni, P. Gervasio et F. Saleri : « Calcul Scientifique : Cours, exercices corrigés et illustrations en MATLAB et OCTAVE », Springer, 2010, ISBN 978-88-470-1676-7.
- A. Quarteroni, R. Sacco et F. Saleri : « Méthodes Numériques - Algorithmes, analyse et applications », Springer, 2007, ISBN 978-88-470-0495-5.
- J. Rappaz et M. Picasso: "Introduction à l'analyse numérique", PPUR - Collection: Enseignement des mathématiques - 2em édition - 2011

Ressources en bibliothèque

- [calcul scientifique / Quarteroni](#)
- [Scientific Computing with MATLAB and OCTAVE](#)
- [Numerical Mathematics / Quarteroni](#)
- [Méthodes Numériques -Algorithmes analyse](#)

- [Introduction à l'analyse numérique](#)

Notes/Handbook

Lecture notes will be provided as well as the handwritten notes used during the theory lectures. The recorded videos of the theory lectures will also be available to the students.

Moodle Link

- <https://moodle.epfl.ch/course/view.php?id=14841>

Videos

- <https://www.edx.org/course/matlab-octave-beginners-epfl-matlabeoctavebeginnersx>
- <https://www.edx.org/course/matlab-et-octave-pour-debutants-epfl-matlaboctavex-0>
- <https://www.coursera.org/learn/analyse-numerique>