UCLouvain

linma1170

2019

Numerical analysis

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 22.5 h	Q1

Teacher(s)	Henrotte François (compensates Remacle Jean-François) ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	• Numerical methods for solving non-linear equations • Numerical methods for solving linear systems : iterative methods • Numerical methods for solving eigenvalue and eigenvector problems • Numerical solution of ordinary differential equations : initial value problems
Aims	With respect to the AA reference, this course contributes to the development, acquisition and evaluation of the following learning outcomes : AA1.1, AA1.2, AA1.3 AA2.1, AA2.4 AA5.2, AA5.3, AA5.5 More precisely, after completing this course, the student will have the ability to : 1 • Analyze in depth the various key methods and algorithms for the numerical solution of important classes of problems from science and industry, related to applied mathematics • Better understand the numerical behavior of the various numerical algorithms for the solution of linear as well as nonlinear problems • Implement these methods in a high level computer language and verify their numerical behavior on a practical problem Transversal learning outcomes : • Collaborate in a small team to solve a mathematical problem using numerical methods - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Exam (50% of the grade) and homeworks (50% as well)
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • Classes organized following the EPL guidelines. • Homeworks done individually • A more detailed organization is specified each year in the course plan provided on Moodle.
Content	• Reminder of the basic notions of linear algebra (linear spaces, vector and matrix norms, ...) • Floating point calculations. • Stability, precision and conditioning of algorithms. • QR and SVD factorizations. • Linear systems of equations : direct methods. LU, Choleski, Pivoting, Renumbering (RCMK), direct resolution of sparse systems, Fill-in. • Iterative methods (Krylov subspaces) : iteration of Arnoldi, conjugate gradients, GMRES, Lanczos. • Preconditioning of iterative methods, preconditioned conjugated gradients. • Computing eigenvalues, QR algorithm
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=10034

Bibliography	• http://bookstore.siam.org/ot50/ Nous suivons relativement scrupuleusement l'excellent ouvrage : Trefethen, L. N., & Bau III, D. Numerical linear algebra (Vol. 50). Siam.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Statistic: General	STAT2M	5		
Additionnal module in Mathematics	LMATH100P	5		
Minor in Engineering Sciences: Applied Mathematics (only available for reenrolment)	LMAP100I	5		
Minor in Applied Mathematics	LFSA136I	5		
Specialization track in Applied Mathematics	LMAP100P	5		