UCLouvain

linma1170

2023

Numerical analysis

5.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Remacle Jean-François ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	First cycle level in numerical calculus and programming (LEPL1104) and in linear algebra (LEPL1101).
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
Learning outcomes	**At the end of this learning unit, the student is able to :** 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
Evaluation methods	Exam (50% of the grade) and homeworks (50% as well)
Teaching methods	• 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	Learning outcomes
Additionnal module in Mathematics	APPMATH	5		
Minor in Applied Mathematics	LMINOMAP	5		
Specialization track in Applied Mathematics	FILMAP	5		
Mineure Polytechnique	MINPOLY	5		