UCL Université catholique de Louvain

LINMA2710

2014-2015

Numerical algorithms

5.0 credits	30.0 h + 22.5 h	2q

Teacher(s) :	Van Dooren Paul ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=INMA2170
Prerequisites :	Basic knowledge (1st cycle) in numerical analysis and programming (MATLAB)
Main themes :	-- Quantitative study of floating point rounding errors -- Specification of the notions of "numerical stability" and "conditioning" -- Development of iterative methods and convergence criteria that are computer-independent -- Examples of complexity analysis of algorithms -- Development of high performance parallel algorithms
Aims :	After successful completion of this course, the student will : -- be able to analyse the different computational aspects of numerical algorithms; he will have a better understanding of stability of an algorithm and conditioning of a problem, as well as of convergence, precision and complexity of numerical algorithms. -- be able to analyse these properties for different types of numerical algorithms -- have shown how to use his theoretical background in the design of algorithms for specific numerical problems. *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 :	The evaluation of the students is partly based on an exam organized according to the rules imposed by the EPL. The exam material corresponds to the contents of the course material, with the possible exception of certain parts specified in a document available on iCampus after the last session of the course. The other part of the evaluation is based on the homeworks made during the semester. More elaborate information on the on the evaluation procedure is given in the course plan, made available on iCampus at the beginning of the academic year.
Teaching methods :	-- Regular classes with a schedule fixed by the EPL. -- Exercises or homeworks made individually or in small groups, with the possibility to consult teaching assistants. Solutions to the problems are made available afterwards.
Content :	After a short introduction recalling some basic notions, the following topics are addressed : -- Machine representation of real numbers and the corresponding IEEE standard -- Qualitative analysis of rounding errors -- Definition of numerical stability and conditioning -- Convergence of iterative algorithms -- Critical analysis of classical algorithms illustrating these basic concepts -- LU factorisation of matrices -- Iterative refinement --

	Bloc methods and parallel algorithms -- Algorithms for polynomials -- Fast matrix multiplication -- Fast Fourier Transform
Bibliography :	The course material consists of reference books, course notes and complimentary material made available via iCampus. Reference book : -- Nick Higham (1995). Accuracy and Stability of Numerical Algorithms, SIAM Publ. Philadelphia.
Other infos :	The organisation details are given every year in the course plan.
Cycle and year of study :	> Master [120] in Computer Science > Master [120] in Computer Science and Engineering > Master [120] in Mathematical Engineering
Faculty or entity in charge:	MAP