UCL Université catholique de Louvain

LINMA2460

2013-2014

Optimization : Nonlinear programming

5.0 crédits	30.0 h + 22.5 h	2q

Enseignants:	Nesterov Yurii ;
Langue d'enseignement:	Anglais
Lieu du cours	Louvain-la-Neuve
Ressources en ligne:	The full syllabus (in English) can be downloaded from the web page of the course.
Préalables :	LFSAB1102 (Mathématiques 2) Basic knowledge of Nonlinear Analysis and Linear Algebra. The target audience is the students interested in scientific computing, machine learning and optimization in engineering.
Thèmes abordés :	-- General nonlinear optimization. -- Smooth and non-smooth convex optimization. -- Interior-point methods.
Acquis d'apprentissage	Learning outcomes: -- AA1.1, AA1.2, AA1.3 -- AA2.1 -- AA5.2, AA5.3 After this course, the student will be able to : -- Estimate the actual complexity of Nonlinear Optimization problems. -- Apply lower complexity bounds, which establish the limits of performance of optimization method. -- Explain the main principles for constructing the optimal methods for solving different types of minimization problems. -- Use the main problem classes (general nonlinear problems, smooth convex problems, nonsmooth convex problems, structural optimization ' polynomial-time interior-point methods). -- Understand the rate of convergence of the main optimization methods. -- Two testing computer projects give a possibility to compare the theoretical conclusions and predictions with real performance of minimization methods Additional benefits : -- Training in scientific English -- Experience in solving difficult nonlinear optimization problems *La contribution de cette UE au développement et à la maîtrise des compétences et acquis du (des) programme(s) est accessible à la fin de cette fiche, dans la partie « Programmes/formations proposant cette unité d'enseignement (UE) ».*
Modes d'évaluation des acquis des étudiants :	In the written exam (in English or French) there are four questions, one for each chapter of the course (up to 5 points for each question). The marks for the exam and the exercises are combined in the final mark.
Méthodes d'enseignement :	The course is given in 12-15 lectures. The computer projects are implemented by the students themselves with supporting consultations.
Contenu :	--

	General problem of nonlinear optimization. Black-box concept. Iterative methods and analytical complexity. Gradient method and Newton method. Local complexity analysis. -- Convex optimization: convex sets and functions; minimization of differentiable and non-differentiable convex functions; lower complexity bounds; optimal methods. -- Interior-point methods: notion of self-concordant functions and barriers; path-following methods; structural optimization.
Bibliographie :	-- Yu.Nesterov. "Introductory lectures on convex optimization. Basic course", Kluwer 2004 -- P. Polyak, « Introduction in optimization », J. Willey & mp; Sons, 1989 -- Yu. Nesterov, A. Nemirovsky, « Interior-point polynomial algorithms in nonlinear optimization », SIAM, Philadelphia, 1994.
Cycle et année d'étude: :	> Master [120] : ingénieur civil en mathématiques appliquées
Faculté ou entité en charge:	MAP