UCLouvain

linma2460

2017

Optimization : Nonlinear programming

5 crédits	30.0 h + 22.5 h	Q2

Enseignants	Nesterov Yurii ;
Langue d'enseignement	Anglais
Lieu du cours	Louvain-la-Neuve
Préalables	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 : 1. Estimate the actual complexity of Nonlinear Optimization problems. 2. Apply lower complexity bounds, which establish the limits of performance of optimization method. 3. Explain the main principles for constructing the optimal methods for solving different types of minimization problems. 4. Use the main problem classes (general nonlinear problems, smooth convex problems, nonsmooth convex problems, structural optimization ' polynomial-time interior-point methods). 5. Understand the rate of convergence of the main optimization methods. 6. 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 1 - - - - *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.
Ressources en ligne	The full syllabus (in English) can be downloaded from the web page of the course.
Bibliographie	• Yu.Nesterov. "Introductory lectures on convex optimization. Basic course", Kluwer 2004 • P. Polyak, « Introduction in optimization », J. Willey & Sons, 1989 • Yu. Nesterov, A. Nemirovsky, « Interior-point polynomial algorithms in nonlinear optimization », SIAM, Philadelphia, 1994.

Faculté ou entité en charge:	MAP

Programmes / formations proposant cette unité d'enseignement (UE)				
Intitulé du programme	Sigle	Crédits	Prérequis	Acquis d'apprentissage
Master [120] : ingénieur civil en science des données	DATE2M	5		
Master [120] : ingénieur civil en mathématiques appliquées	MAP2M	5		
Master [120] en science des données, orientation technologie de l'information	DATI2M	5		