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Ph.D. course

# Algorithms for nonsmooth optimization

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**Given by** Giancarlo Bigi, Università di Pisa, giancarlo.bigi@unipi.it

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**Where** DIAG, Sapienza Università di Roma, room B203, Via Ariosto 25, Roma

**Abstract** Nonsmoothness arises naturally in many applications (e.g., signal processing via lasso regression, compressive sensing) as well as in development of optimization theory itself (e.g., duality, penalization). Convexity provides a valuable theoretical framework to compensate for the possible lack of smoothness of functions at [and/or nearby] minimizers. These lectures aim at providing a brief overview of the main tools of convex analysis and their exploitation in the development of algorithms for mathematical programs with nonsmooth data. Some pointers to suitable tools for the development of calculus for locally Lipschitz nonconvex functions are given as well.

**Main topics** Sources of nonsmoothness • Convex and nonsmooth analysis • Subgradient algorithms • Cutting plane algorithms and bundling techniques • Proximal gradient algorithms • Smoothing techniques

**Main references** A. Beck, *First-Order Methods in Optimization*, SIAM, 2017.

D.P. Bertsekas, *Convex Optimization Algorithms*, Athena, 2015.

F.H. Clarke, *Optimization and Nonsmooth Analysis*, Wiley, 1983.

J.-B. Hiriart-Urruty, C. Lemaréchal, *Convex Analysis and Minimization Algorithms*, Springer, 1996.