GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

Nanoscale Photonic Imaging SFB 755

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Lecture series

on

Nonsmooth Analysis and Optimization

by

Prof. Dr. Christian Clason, Universität Duisburg-Essen

August 8-11, 2017; 10:15 am-11:45 am

Venue: Institute for Mathematical Stochastics, Goldschmidtstr. 7, SR 5.101

Abstract:

In classical nonlinear optimization, both the theory (necessary optimality conditions) and practice (gradient, Newton-like methods) are based on the differentiability of the function to be minimized. However, this property does not hold for many relevant functions such as the $L^{\wedge 1}$ norm or indicator functions describing additional constraints. The aim of this course is to present generalized derivative concepts that can be used to derive useful optimality conditions and implementable algorithms for nondifferentiable optimization problems arising in inverse problems and imaging.

Contents:

Lecture 1 (August 8): **Convex analysis**
(convex subdifferentials and their calculus, Fenchel conjugates and duality, examples)

Lecture 2 (August 9): **Monotone operators and proximal points**
(maximal monotone operators, resolvents and proximal point mappings, Moreau-Yosida regularization, examples)

Lecture 3 (August 10): **First-order splitting methods**
(abstract proximal point method, forward-backward splitting, primal-dual extragradient (Chambolle-Pock) method)

Lecture 4 (August 11): **Semismooth Newton methods**
(generalized Newton methods, Newton differentiability, piecewise differentiable functions, examples)

Literature:

- H. Bauschke, P. Combettes: Convex Analysis and Monotone Operator Theory in Hilbert Spaces, 2nd ed., Springer, 2017.
- F. Clarke: Functional Analysis, Calculus of Variations and Optimal Control, Springer, 2013.
- W. Schirotzek, Nonsmooth Analysis, Springer, 2007.
- M. Ulbrich: Semismooth Newton Methods for Variational Inequalities and Constrained Optimization Problems in Function Spaces, SIAM, 2011.