

Optimization and Equilibrium Problems with Singular Solutions: Theory and Numerical Methods

Initiative: Trilaterale Partnerschaften - Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

Ukraine, Russland und Deutschland

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A concept of critical solutions of smooth equations, developed in the preceding project, and extending the related concept for equality-constrained optimization problems, turned out to be very useful for understanding stability properties of singular (and in particular nonisolated) solutions, as well as the behavior of Newton-type methods near them. The current project aims, in particular, at extensions of the criticality concept and related theories to new classes of variational problems, including equations with nonpolyhedral constraints, as well as problems with relaxed smoothness assumptions. To a great extent, these studies will rely upon mathematical tools to be developed in the project. In particular, the study of stability and sensitivity issues for constrained equations will much rely on covering results, while the study of singular optimal controls will use the global implicit function theorems. Theoretical developments in this project will be accompanied by design and analysis of new numerical methods for solving problems in question. To deal with singular solutions, it is planned to extend existing Newton-type techniques and to develop new algorithmic approaches that result from expected theoretical findings. For cases where Newton-type methods are not appropriate, the design of subgradient methods with space transformations is intended and shall aim at accelerating convergence speed and increasing reliability. Moreover, the range of applicability shall cover problems with possibly nonisolated solutions, nonsmooth convex programs, and saddle-point problems. In the project, these developments will be exploited for solving diffcult problems arising from applications in image processing and optimal packing.

Projektbeteiligte

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Newton-type methods near critical solutions of piecewise smooth nonlinear equations Unit stepsize for the Newton method close to critical solutions Sparse balanced layout of spherical voids in three-dimensional domains Variational principles and mean value estimates Balanced circular packing problems with distance constraints