Berlin Mathematics Research Center

MATH+

MATH+ Spotlight Talk

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A Semismooth Newton Method for Obstacle-Type Quasivariational Inequalities

Abstract:

Quasivariational inequalities (QVIs) are ubiquitous in nature and are the natural choice for modeling physical interactions between different objects. This ranges from making your morning coffee to locking your door as you leave your home and even to hugging your loved ones.

Mathematically, they arise in PDE-constrained optimization in cases where the constraint set depends on the solution itself. In obstacle-type QVIs, this manifests as an obstacle that bends according to the state of the system.

QVIs are notoriously hard to analyze, especially in the infinite-dimensional setting, and developing fast solvers posed in infinite dimensions has proven particularly challenging. As such most solvers in the literature rely on fixed point algorithms which can be slow to converge. In this talk, we introduce the first semismooth Newton method, posed in a Banach space setting, for such problems. We will see that the solver enjoys favourable properties such as local superlinear convergence and mesh independence.

This work is co-authored with Amal Alphonse, Constantin Christof, and Michael Hintermüller.