

Abstract

Oberwolfach Workshop:

Variational Methods for Evolution

Dates:

3 Dec - 9 Dec 2023 (ID: 2349)

Organizers:

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Variational principles for evolutionary systems arise in many settings, both in those describing the physical world and in man-made algorithms for data science and optimization tasks. Variational principles are available for Hamiltonian systems in classical mechanics, gradient flows for dissipative systems, as well as in time-incremental minimization techniques for more general evolutionary problems. The new challenges arise via the interplay of two or more functionals (e.g. a free energy and a dissipation potential), thus encompassing a large variety of applications in the modeling of materials and fluids, in biology, and in multi-agent systems.

Variational principles and associated evolutions are also at the core of the modern approaches to machine learning tasks, since many of them are posed as minimizing an objective functional that models the problem. The discrete and random nature of these problems and the need for accurate computation in high dimension present a set of challenges that require new mathematical insights. Variational methods for evolution allow for the usage of the rich toolbox provided by the calculus of variations, metric-space geometry, partial differential equations, and other branches of applied analysis.

The variational methods for evolution have seen a rapid growth over the last two decades, and this workshop aims to continue the successful line of meetings (2014, 2017, and 2020), while evolving and branching into new directions. We bring together a wide scope of mathematical researchers from calculus of variations, partial differential equations, analysis, and stochastics, with researchers from data science and machine learning, to exchange ideas, foster interaction, develop new avenues, and generally bring these communities closer together.