Oberwolfach Workshop: 26 May - 31 May 2024

Title: Constrained dynamics, stochastic numerical methods and the modeling of complex systems

Organizers:

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Abstract:

The goal of this workshop is to bring together researchers from diverse areas of mathematics and statistics to focus on the foundations for high dimensional modeling and computational study. The meeting will address recent developments in numerical analysis, dynamical systems, and stochastic differential equations which support model reduction for large scale complex systems.

It is well known that incorporating targeted geometric structures (e.g. Riemannian manifolds) into large scale statistical models can enhance the stability, reliability and efficiency of numerical methods. But algorithms are frequently presented in application contexts without adequate attention to their fundamental properties. The lack of rigor and attention to mathematical foundations may substantially limit the uptake of modeling methods that incorporate geometric structure and inference methods.

It is necessary to understand the fundamental properties of the structures involved, the impact of those structures in dynamics and stochastic dynamics, and to redesign algorithms in order to capture the essential properties with goals such as robustness and suitability for high performance computation in mind.

By bringing together numerical analysts with statisticians and modelers, we hope to enhance the quality of methods and also to identify new model frameworks to guide future development.