Singularities in Discrete Systems

4 May - 9 May 2025

Abstract

Discrete systems pervade the modeling of natural and synthetic phenomena. Interactions between agents at the discrete, microscopic level are at the basis of the onset of collective behavior. The emergence of patterning and structures is often the key to model effects across scales.

The analysis and simulation of discrete models call for taming their inherent multiscale character, as microscopic dynamics lead to the emergence of structures across scales. This provides an abundant source of mathematical challenges, which have driven the rapid development of an active research community.

To these days, the attention has been mostly oriented to the onset of *regular* patterns and homogeneous large-scales states, namely, to crystallization, thermodynamic limits, and homogenization. Recently, the focus is shifting to *singular* situations, such as dislocations, defects, and boundaries. Symmetry breaking in discrete systems generates a wealth of challenging mathematical questions, often requiring the combination of diverse analytical, stochastic, geometric, and numerical techniques. Correspondingly, the workshop is expected to address different themes, from dislocations, chirality, and defects, to interfaces and patterning, to discrete-to-continuum convergence and simulations.

The purpose of the workshop is to gather leading groups working on different aspects of the mathematics of discrete systems, from microscopis modeling, to materials and social sciences, to computations. The ambition is to identify new ways of tackling open problems by sharing information across different fields. The workshop will then be an occasion to get a fresh insight into this rapidly developing research front.