

Symmetry Methods for Differential and Difference Equations

Most well-known techniques for solving differential equations exploit symmetry in some form. This simple observation, due to Sophus Lie, has been developed into a set of systematic methods for finding and using symmetries, first integrals and conservation laws of a given differential equation. Recent research has shown how to extend these powerful methods to difference equations. For instance, there are difference analogues of Noether's two theorems on variational symmetries, together with a new intermediate result. An important application is to determine which finite difference approximations retain conservation laws, Bianchi identities and other essential structures.

In this course, I will describe the basic theory for both differential and difference equations, and I will show how the resulting techniques are used in practice.