

Peter Hilton Memorial Lecture - 2017

Speaker: Konstantin Mischaikow, Rutgers University



Title: A combinatorial/algebraic topological approach to nonlinear dynamics

Time: Thursday April 27, 2017, 3:00 p.m.

Location: Binghamton University, Fine Arts Building, Room 258

The lecture will be followed by a reception at 4:30 p.m. in The President's Reception Room, Anderson Performing Arts Center, Binghamton University. This reception is for the whole Binghamton Mathematics Community as well as for our visitors.

Abstract:

The current paradigm for nonlinear dynamics was introduced by H. Poincare and explicitly formulated in the language of differential topology by S. Smale and R. Thom. It was developed to analyze physical systems with models given in terms of nonlinear equations and well-defined parameters with the goal of describing the behavior of a typical trajectory at a typical parameter value. The resulting theory is incredibly complex and has led to the understanding of extremely sensitive structures in both phase space (chaos) and parameter space (bifurcation theory).

However, with the advent of radically improving information technologies science is being evermore guided by data-driven models and large-scale computation. In this setting one often is forced to work with models for which the nonlinearities are not derived from first principles and quantitative values for parameters are not known.

With this in mind I will describe an alternative approach formulated in the language of combinatorics and algebraic topology that is inherently multiscale, amenable to mathematically rigorous results based on discrete descriptions of dynamics, computable, and capable of recovering robust dynamic structures. To keep the talk grounded I will discuss the ideas in the context of modeling of gene regulatory networks.

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