Bifurcations and applications of low-dimensional polynomial dynamical systems

Valery Gaiko*[1]

[1]United Institute of Informatics Problems (UIIP [Minsk]) – Surganova Str. 6, Minsk 220012, Belarus

Abstract

We carry out the global qualitative analysis of low-dimensional polynomial dynamical systems. Using new bifurcational and topological methods, we solve first Hilbert's Sixteenth Problem on the maximum number and distribution of limit cycles for the general two-dimensional Liénard polynomial system with an arbitrary number of singular points. Then, applying a similar approach, we study three-dimensional polynomial systems and complete the strange attractor bifurcation scenario for the classical Lorenz system connecting globally the homoclinic, period-doubling, Andronov–Shilnikov, and period-halving bifurcations of its limit cycles. We discuss also how to apply our approach for studying global limit cycle bifurcations of discrete polynomial (and rational) dynamical systems which model the population dynamics in biomedical and ecological systems.

This work was partially supported by the Simons Foundation of the International Mathematical Union and the Department of Mathematics and Statistics of the Missouri University of Science and Technology.

*Speaker