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Numerical analysis of local bifurcations

Yuri A. Kuznetsov
*Department of Mathematics
Utrecht University
Budapestlaan 6
Utrecht, 3508 TA
THE NETHERLANDS
kuznet@math.uu.nl*

Experts:

Reza Khoshsiar Ghaziani (Univ. Gent) and
Hil Meijer (Univ. Utrecht).

Abstract

The first lecture will be devoted to the simplest local bifurcations in autonomous smooth ODEs: fold (limit point) and Andronov-Hopf bifurcations of equilibria. In the second lecture I will focus on the simplest bifurcations of limit cycles in ODEs: fold (limit point), period-doubling, and Neimark-Sacker (torus) bifurcations.

In all cases, I will (1) describe phase portraits of their generic unfoldings in the n -dimensional systems; (2) discuss various methods to continue the bifurcations in two parameters; (3) explain how to compute the coefficients of normal forms on the corresponding center manifolds.

The continuation will be based on the minimally extended defining equations - algebraic systems for the equilibria and boundary value problems for the cycles. Bifurcation conditions in such equations will be defined by solving bordered systems. The computation of the normal form coefficients will employ a combined reduction/normalization technique. For the limit cycle bifurcations, periodic normal forms will be used.

Remarks on the implementation of the presented methods in CONTENT and MATCONT will be given.