Implementation of Hopf and double Hopf algorithms in CONTENT

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Abstract

A Hopf point of a dynamical system is an equilibrium solution where the Jacobian matrix has a conjugate pair of complex eigenvalues with real part zero. It is a double Hopf point if there are two such pairs. These cases have important dynamical implications and can be computed using bordered matrices.

In this talk, we discuss the computational study of curves of Hopf and double Hopf points in the software package CONTENT developed at CWI, Amsterdam by Y. A. Kuznetsov and V. V. Levitin. The bialternate product of matrices is extensively used in two codes for single Hopf and one for double Hopf. In the double Hopf and one of the single Hopf cases this is combined with a bordered matrix method.

We illustrate the use of this software with model computations, including the computation of a double Hopf curve in a realistic model of a neuron, developed at Cornell university by J. Guckenheimer and coworkers. The appearance of double Hopf points in such models is a noteworthy phenomenon.

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