Departmental Colloquium

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Codimension-two Bifurcations in Neutral Functional Differential Equations

Abstract:

In this talk, I will report our recent research on the normal forms near codimension two bifurcations in neutral functional differential equations. As an example, we consider the van der Pol's equation with an extended delay feedback control, which is equivalent to a system of neutral differential-difference equations (NDDE). The properties of Bogdanov-Takens bifurcation, Hopf-pitchfork bifurcation and Hopf-Hopf bifurcation are established for this NDDE by appealing to the formal adjoint theory, center manifold theorem and the normal form method. With the aid of the associated normal forms, we describe bifurcation sets in detail and find some interesting phenomena such as the existence of a homoclinic orbit, coexistence of three periodic solutions, coexistence of stable oscillations, quasi-periodic oscillations, and strange attractor for this neutral equation. Our numerical simulations also illustrate these analytic results.