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Nonlinear Oscillation and Multiscale Dynamics in a Closed Chemical Reaction

In this talk, we present the damped nonlinear oscillation and multi-scale dynamics in a closed isothermal chemical reaction system described by the reversible Lotka–Volterra model. This is a three-dimensional, dissipative, singular perturbation to the conservative Lotka–Volterra model, with the free energy serving as a global Lyapunov function. We will show that there is a natural distinction between oscillatory and non-oscillatory regions in the phase space, that is, while orbits ultimately reach the equilibrium in a non-oscillatory fashion, they exhibit damped, oscillatory behaviors as interesting transient dynamics. This is the joint work with Hong Qian and Yingfei Yi.