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DK Seminar

Dec 21, 2016, 14:15 - 15:00
Vienna University of Technology,
Freihaus, green area, 4th floor

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Mixed-mode oscillations, slow manifolds and twin canards

A mixed-mode oscillation (MMO) is a complex waveform with a pattern of alternating small- and large-amplitude oscillations. MMOs have been observed experimentally in many physical and biological applications, and most notably in chemical reactions. We are mainly interested in MMOs that appear in dynamical systems with different time scales. In particular, we consider an autocatalytic model that was modified by Milik and Szmolyan to have an explicit time-scale separation parameter. The mathematical analysis of MMOs is very geometric in nature and based on singular limits of the time-scale ratios. Near the singular limit one finds so-called slow manifolds that guide the dynamics on the slow time scale. In the considered autocatalator model, slow manifolds are surfaces that can be either attracting or repelling. Transversal intersections between attracting and repelling slow manifolds are called canard orbits. Our aim is to study a parameter regime where the time-scale ratio is relatively large. We use continuation methods based on two-point boundary value problems to investigate the underlying complex dynamics of the autocatalator in such a parameter regime. By employing these methods, we observe unexpected phenomena such as twin canard orbits and ribbons of the attracting slow manifold.