Multiscale Modeling and Singular Perturbations

January 11 2008
Universiteit Twente
Cubicus B209

10:00-10:45	Floris Takens	Strange attractors in constrained equations.
10:45-11:30	Ferdinand Verhulst	Algebraic timescales with applications to parametric excitation.
11:30-12:00	coffee break	
12:00-12:45	Arjen Doelman	Pattern formation in reaction diffusion equations.
12:45-14:00	lunch break	
14:00-14:45	Hil Meijer & Stephan van Gils	Deep Brain Stimulation: from thalamic pathology to suppression.
15:00-15:45	Freddy Dumortier	Canard cycles with different fast layers.

abstracts

Takens: Strange attractors in constrained equations.

We discuss persistent strange attractors in simple (only two slow variables) constrained equations. Not only Lorenz like attractors but also attractors which are suspensions of interval maps. In the latter class there are examples where the pattern of bifurcations between periodic and strange attractors is different from what is known for ordinary (smooth) interval maps.

Verhulst: Algebraic timescales with applications to parametric excitation.

In small parameter initial value problems, natural timescales are t and εt. Bifurcation problems arise quite often, producing algebraic timescales of the form $\varepsilon^k t$ with k a positive rational. This changes the perspective of multiple timescale methods as the presence of these timescales is not obvious. We will show this by some examples and applications to basic parametric excitation and to to gyroscopic dynamics involving the Whitney umbrella.

Dumortier: Canard cycles with different fast layers.

The talk deals with two-dimensional slow-fast systems and more specifically with canard cycles passing through different fast layers. We show how to study the relaxation oscillations that can be perturbed from such canard cycles.

Doelman: Pattern formation in reaction diffusion equations.

van Gils + Meijer: Deep Brain Stimulation: from thalamic pathology to suppression.

In this talk we give an overview of earlier work of Rubin and Terman on mathematical aspects of Deep Brain Stimulation in relation to Parkinsons Disease and we present new results on the blocking of rebound potentials in the Subthalamic Nucleus that are a side effect of received Parkinsonian input.