

研究生教育创新计划高水平学术前沿讲座日

---Dynamical Systems Day

时间： 2013 年 6 月 13 日

地点： 管理科研楼1611 教室

邀请报告人：

Shui-Nee Chow (Georgia Institute of Technology, USA)

Jibin Li (Zhengjiang Normal Univesity, China)

Zeng Lian (Loughborough University, UK)

John Mallet-Paret (Brown University, USA)

Haomin Zhou (Georgia Institute of Technology, USA)

主办： 中国科学技术大学数学科学学院

组委会： 叶向东、黄文、王毅、邵松、梁兴

## Program

Time	Speaker	Title
9:15-10:00	John Mallet-Paret	Recent Progress in Delay-Differential Equations
10:10-10:55	Shui-Nee Chow	Homoclinic Orbits for NLS with Spatially-Dependent and Unbounded Perturbations
10:55-11:40	Haomin Zhou	Local Adaptive Iterative Filtering Method for Signal decompositions and Instantaneous Frequency analysis.
11:45-14:15		Lunch&Break
14:20-15:05	Zeng Lian	Absolute continuity of stable foliations, ergodic attractors and SRB type measures for systems in infinite dimensional spaces
15:15-16:00	Jibin Li	Travelling Wave Solutions in a Nonlinear diffusion-Convection-Reaction Equation

## Abstract

### Shui-Nee Chow (Georgia Tech)

**Title:** Homoclinic Orbits for NLS with Spatially-Dependent and Unbounded Perturbations

**Abstract:** For an integrable focusing cubic nonlinear Schrodinger equation (NLS) under spatial periodic boundary conditions, it is known that there are whiskered tori which form heteroclinic orbits to steady states or homoclinic orbits to periodic orbits with different asymptotic phases as time approaches plus and minus infinity. In this work, we consider the integrable NLS under diffusive (unbounded) perturbation and spatially dependent time periodic forcing and show (based on singular perturbation method) that there exist orbits homoclinic to some saddle points. In particular, these orbits are formed by joining some unperturbed heteroclinic orbits and periodic orbits which are resonant to the perturbation frequency. We note that as the normally elliptic invariant slow manifold does not necessarily persist under the spatially-dependent forcing, we need to apply a modified averaging technique to obtain a sufficiently accurate approximate invariant slow manifold. Moreover, as the diffusive perturbation appears as one of the highest order derivative terms in our perturbed NLS, its flow is non-differentiable with respect to the

perturbation parameters in the same phase space. It is interesting to note we can actually prove that certain invariant manifolds are smooth with respect to the perturbation parameters. This is joint work with Yi Wang (USTC) and Chongchun Zeng (GT).

### **Jibin Li (Zhejiang Normal Univ.)**

**Title:** Travelling Wave Solutions in a Nonlinear Diffusion-Convection-Reaction Equation

**Abstract:** For a general nonlinear diffusion-convection equation, the existence of uncountably infinite many global monotonic wavefront solutions and semi-wavefront solutions with bounded support is proved. By using the method of planar dynamical systems, the dynamical behavior of the corresponding traveling wave system is discussed. For some concrete nonlinear diffusion-convection equations, more than thirty exact explicit parametric representations of the wavefront solutions, semi-wavefront solutions and unbounded traveling wave solutions are given.

### **Zeng Lian (Loughborough Univ.)**

**Title:** Absolute continuity of stable foliations, ergodic attractors and SRB type measures for systems in infinite dimensional spaces

**Abstract:** To study the infinite dimensional dynamical system, one of the ideas is to reduce the system to some smaller system, e.g. a finite dimensional system or system on a compact set. Some basic questions raise here, for example: Are these "small" sets observable? How does the "small" system reflect the behaviors of the original system? In this talk, I will introduce two sets of results, which may answer part of the above questions under two different situations.

### **John Mallet-Paret (Brown Univ.)**

**Title:** Recent Progress in Delay-Differential Equations

**Abstract:** We examine several problems in delay-differential equations. Among the new results we discuss are existence and asymptotics for multiple-delay problems, global bifurcation of periodic solutions, analyticity (or lack thereof) in variable-delay problems, and spectral properties of variable-delay Volterra operators.

### **Haomin Zhou (Georgia Tech)**

**Title:** Local Adaptive Iterative Filtering Method for Signal decompositions and Instantaneous Frequency analysis.

**Abstract:** The empirical mode decomposition (EMD) was a method pioneered by Huang et al, as an alternative technique to the traditional Fourier and wavelet techniques for nonlinear and non-stationary signals. It decomposes a signal into several components called intrinsic mode functions (IMFs), which have shown to admit better behaved instantaneous frequencies via Hilbert transforms. In this talk we present our recent progress on an alternative algorithm for EMD based on iterative filtering (IF) method. The filters are generated by the Fokker-Planck equations, second order linear PDEs for diffusion processes. This method is highly localized nonlinear and data dependent, and easy to be implemented and generalized to higher dimensions. It yields similar results as the traditional sifting algorithm for EMD. We give the conditions under which the local adaptive IF method converges. And we presents a different way to perform instantaneous frequency analysis. This talk is based on collaborated work with Jingfang Liu(Georgia Tech), Antonio Cicone (Georgia Tech) and Shui-Nee Chow. (Georgia Tech)