微分方程与动力系统青年研讨会

2020 年 10 月 26-28 日

上海交通大学

　　本次在线研讨会的主题包括：常微分方程定性理论，哈密顿动力系统，微分动系统，拓扑动力系统，及遍历论等等，旨在促进青年学者间的广泛交流。

组织委员会： 陈贤峰、唐异垒、王楷植、王晓东、肖冬梅、于江、张祥

主办单位： 上海交通大学数学科学学院，常微分方程与动力系统课题组

2020 年秋

一、日程（腾讯会议）

时间	报告人	报告题目	主持
13:20-13:30	开幕式（肖冬梅）		主持
13:30-14:15	冀书关	Periodic solutions of nonlinear wave equations with general variable coefficients	张祥
14:15-15:00	蒋晓萌	Stochastic Levinson's conjecture	
15:00-15:45	许璐	Poincare Mechanism in Multi-scaled Hamiltonian Systems	
15:45-16:00	休息		
16:00-16:45	熊艳琴	Limit cycle bifurcations by perturbing a class of planar quintic vector fields	唐异垒
16:45-17:30	孙宪波	Cyclicity of periodic annulus and Hopf cyclicity in perturbing a hyper-elliptic Hamiltonian system with a degenerate heteroclinic loop	

时间	报告人	报告题目	主持
8:30-9:15	周喆	The Rotation Number for the Schrodinger Operator with Almost Periodic Measures: Absolutely Continuous Case	陈贤峰
9:15-10:00	周麒	Phase transition and mobility edge	
10:00-10:15	休息		
10:15-11:00	朱昊	The number of traveling wave families in a running water with Coriolis force	王晓东
11:00-11:45	吴事良	Entire solutions originating from multiple fronts of an epidemic model with nonlocal dispersal and bistable nonlinearity	
	中午休息		
13:30-14:15	薛金鑫	Arnold 扩散与黑洞动力学	王晓东
14:15-15:00	廖刚	Symbolic extensions for 3-dimensional diffeomorphisms	
15:00-15:45	吴楚芬	Non-monotone waves of a stage-structured SLIRM epidemic model with latent period	
15:45-16:00	休息		
16:00-16:45	李锋	幂零奇点的焦点量计算与几类极限环分支	于江
16:45-17:30	周林锋	Admissibility and Roughness of Nonuniform Exponential Dichotomies	

时间	报告人	报告题目	主持
8:30-9:15	史逸	Spectrumrigidity and dynamical Frobenius theorem for Anosov diffeomorphisms	王楷植 唐异垒
9:15-10:00	周鹏	Dynamics of competitive systems	
10:00-10:15	休息		
10:15-11:00	张金华	Existence and finiteness of physical measures for star flows	王晓东
11:00-11:45	吴奎林	Periodic perturbation of a differential equation	
	结束		

二、会议 ID 及链接（腾讯会议）

会议时间：2020/10/26 13:00-18:30
点击链接入会，或添加至会议列表：
https://meeting.tencent.com/s/0K9zSd4EMpUT
会议 ID：587 383 997

会议时间： 2020/10/27 08:00-18:30
点击链接入会，或添加至会议列表：
https://meeting.tencent.com/s/vx6h7DBRdp89
会议 ID：452 919 042

会议时间：2020/10/28 08:00-12:30
点击链接入会，或添加至会议列表：
https://meeting.tencent.com/s/MlPFHXrAS72i
会议 ID：826 353 574

三、报告题目及摘要

Periodic solutions of nonlinear wave equations with general variable coefficients

冀书关（吉林大学）

Abstract: The model of variable coefficient wave equation arises from the forced vibrations of a bounded nonhomogeneous string and the propagation of seismic waves in nonisotropic media. The problem of finding periodic solutions for this model was considered by Barbu and Pavel for the first time in (Trans Am Math Soc 349:2035－2048, 1997), where they required the variable coefficients must be strictly convex and left other cases as an open problem. In this talk, we shall consider the wave equation with general variable coefficients and talk about some results on this topic.

Stochastic Levinson's conjecture

蒋晓萌（吉林大学）

Abstract: This is a joint work with Yong Li and Xue Yang. We verified the stochastic version of Levinson's conjecture, which confirmed the existence of stochastic periodic solutions for second order Newtonian systems with dissipativeness. We provided a stochastic Duffing's equation to display our result. The main tools are Wong-Zakai approximation method, Lyapunov's method and Horn's fixed point theorem.

幂零奇点的焦点量计算与几类极限环分支

李锋（临沂大学）

摘要：本报告中我们主要介绍幂零奇点附近的轨线结构，中心型幂零奇点的焦点量计算、幂零奇点的解析中心以及几种不同的极限环分支现象。我们将这些结论应用到 Kukles 系统，得到了幂零奇点的中心条件并讨论其极限环个数问题。

Symbolic extensions for 3-dimensional diffeomorphisms

廖刚（苏州大学）

Abstract: The coding of dynamical system is a way to simulate chaotic behavior by symbolic dynamics. We prove that every C^r diffeomorphism with r>1 on a three-dimensional manifold admits symbolic extensions, i.e. topological extensions which are subshifts over a finite alphabet. This answers positively a conjecture of Downarowicz and Newhouse in dimension three. This is a joint work with David Burguet.

Spectrumrigidity and dynamical Frobenius theorem for Anosov diffeomorphisms

史逸（北京大学）

Abstract: Let $A \in SL(n,Z)$ be an irreducible hyperbolic matrix admitting simple spectrum with different moduli. We show that for every $f \in Diff^2 (Tn)$ which is C^1-close to A, the stable and strong unstable bundles of f are jointly integrable if and only if f admits spectrumrigidity in the center unstable bundle dominated between them.

Cyclicity of periodic annulus and Hopf cyclicity in perturbing a hyper-elliptic Hamiltonian system with a degenerate heteroclinic loop

孙宪波（广西财经学院）

Abstract: In this talk, we discuss the cyclicity of periodic annulus and Hopf cyclicity in perturbing a quintic Hamiltonian system. The undamped system is hyper-elliptic, non-symmetric with a degenerate heteroclinic loop, which connects a hyperbolic saddle to a nilpotent saddle. We rigorously prove that the cyclicity is 3 for periodic annulus when the weak damping term has the same degree as that of the associated Hamiltonian system. When the smooth polynomial damping term has degree n, first, a transformation based on the involution of the Hamiltonian is introduced, and then we analyze the coefficients involved in the bifurcation function to show that the Hopf cyclicity is $\big[\frac{2n+1}{3}\big]$. Further, for piecewise smooth polynomial damping with a switching manifold at the y-axis, we consider the damping terms to have degrees l and n, respectively, and prove that the Hopf cyclicity of the origin is $\big[\frac{3l+2n+4}{3}\big]$($\big[\frac{3n+2l+4}{3}\big]$) when $l\geq n$ ($n\geq l$).

Non-monotone waves of a stage-structured SLIRM epidemic model with latent period

吴楚芬（佛山科学技术学院）

Abstract：We propose and investigate a stage-structured SLIRM epidemic model with latent period in a spatially continuous habitat. We first show the existence of semi-traveling waves that connect the unstable disease-free equilibrium as the wave coordinate goes to $-\infty$, provided that the basic reproduction number $\mathcal{R}_0>1$ and $c>c_*$ for some positive number c_*. We then use a combination of asymptotic estimates, Laplace transform and Cauchy's integral theorem to show the persistence of semi-traveling waves. Based on the persistent property, we construct a Lyapunov functional to prove the convergence of the semi-traveling wave to an endemic (positive) equilibrium as the wave coordinate goes to $+\infty$. In addition,

by the Laplace transform technique, the non-existence of bounded semi-traveling wave is also proved when $\mathcal {R}_0>1$ and $0<c<c_*$. This indicates that c_* is indeed the minimum wave speed. Finally simulations are given to illustrate the evolution of profiles. This is a joint work with Prof. Wenzhang Huang

Periodic perturbation of a differential equation

吴奎林（贵州大学）

Abstract:　In this talk, we consider the following equation

$$\ddot{x} + \varepsilon\ h(t)\dot{x} + \Big(1 + \varepsilon\ f(t)\Big)x = 0,$$

where ε sufficiently small and f(t), h(t) are periodic functions. We use averaging theory to discuss the resonant conditions, periodic solutions and quasi-periodic solutions of the equation.

Entire solutions originating from multiple fronts of an epidemic model   with nonlocal dispersal and bistable nonlinearity

吴事良（西安电子科技大学）

Abstract: This talk is concerned with the entire solutions of a nonlocal dispersal epidemic model which arises from the spread of fecally–orally transmitted diseases. Under bistable assumptions, it is well-known that this model has three different types of traveling wave fronts. We first prove the uniqueness, Liapunov stability and continuous dependence on shift parameters of annihilating-front entire solutions. A positive time-derivative estimate for such entire solution is also obtained. Then, we establish the existence of two different types of entire solutions merging three different fronts. Furthermore, we show that these entire solutions are global Lipschitz continuous with respect to the spatial variable x.

Limit cycle bifurcations by perturbing a class of planar quintic vector fields

熊艳琴 (南京信息工程大学)

Abstract：This paper first investigates all possible phase portraits of a class of planar quintic vector field given by

$$
\dot{x}=(1+2bx^2+2dx^4)y,\ \ \ \dot{y}=-2(2ax^2+by^2+3cx^4+2dx^2y^2)x,\ \ a,~b,~c,~d\in\mathbb{R}.
$$

Then, we study the bifurcation problem of its small perturbed vector field with polynomial perturbations of arbitrary degree $n,~n\in\mathbb{N}$ by the

corresponding Abelian integral, and prove that the lower bound for the maximal number of limit cycles bifurcating from the periodic orbits is $3[\frac{n-1}{2}]-1,~n\geq5$.

Poincare Mechanism in Multi-scaled Hamiltonian Systems

许璐（吉林大学）

Abstract: My talk is about the quasi-periodic motions in multi-scaled Hamiltonian systems. It consists of four part. At _rst, I will introduce the results in integrable Hamiltonian systems since what we focus on is nearly-integrable Hamiltonian system. The second part is the de_nition of nearly-integrable Hamiltonian system and the classical KAM theorem. After then, I will introduce that what is Poincar_r problem and some interesting results corresponding to this problem. The last part, which is also the main part, I will talk about the de_nition and the back ground of nearly-integrable Hamiltonian system, then the persistence of lower dimensional tori on resonant surface, which is our recent result. I will also simply introduce the Technical ingredients of our work.

Arnold 扩散与黑洞动力学

薛金鑫（清华大学）

摘要：我们考虑黑洞背景下的粒子的测地运动，并用哈密顿动力系统的方法进行研究。我们借助黑洞的光圈得到 Arnold 扩散的轨道。Arnold 扩散是近可积哈密顿动力系统的一个典型的不稳定现象。这种轨道有明显的物理意义并可以观测。在远离视界的区域，我们可以类比牛顿三体问题，得到振荡轨道的存在性。最后我们证明，扭转映射的理论可以用于研究光圈的动力学，以及拟周期振荡。

Existence and finiteness of physical measures for star flows

张金华（北京航空航天大学）

Abstract: Star flows are considered as "most" hyperbolic systems when the systems exhibit singularities. For hyperbolic systems, Sinai, Rulle and Bowen showed that there exists finitely many physical measures and their basins have full Lebesgue-measure. Palis conjectured that most systems should exhibit finitely many physical measures and their basin cover the whole manifold in the sense of Lebesgue measure. In this talk, we will show that for star flows Palis conjecture holds. This is a joint work with S. Crovisier, X. Wang and D. Yang.

Admissibility and Roughness of Nonuniform Exponential Dichotomies

周林锋（四川大学）

Abstract: Nonuniform exponential dichotomy describes nonuniform hyperbolicity for linear dynamical systems. In this talk, advances on the relationship between admissibility of function classes and nonuniform exponential dichotomies, and roughness of nonuniform exponential dichotomies are introduced.

Dynamics of competitive systems

周鹏（上海师范学院）

Abstract: I this talk, I will firstly review some classical results on competitive ODE and reaction diffusion models. Then focusing on the non-self-adjoint systems involving advection terms, I will report some recent development in this direction with an emphasis on how to deal with the advection terms which causes some difficulties in the qualitative analysis of both semi-trivial and positive steady states.

Phase transition and mobility edge

周麒（南开大学）

Abstract：The spectral theory of quasiperiodic operators is a fascinating field which continuously attracts a lot of attentions for its rich background in quantum physics as well as its rich connections with many mathematical theories and methods. In this lecture, I will focus on the research from the spectral measure side, especially on the problem of phase transition and mobility edge, the proof is based on method from dynamical systems.

The Rotation Number for the Schrodinger Operator with Almost Periodic Measures: Absolutely Continuous Case

周喆（中科院应用数学所）

Abstract：The Schr\"odinger equation describes the wave function of a quantum mechanical system. To understand the long-term behavior of solutions, the spectral analysis of the Schr\"odinger operator is the key issue. In the seminal work [Johnson and Moser, CMP, 1982], the authors used the rotation number approach to determine the spectrum of the one-dimensional almost-periodic Schr\"odinger operator. In this talk, we will consider the Schr\"odinger operator with almost periodic measures. As a first step, we will consider a special case that the measure is absolutely continuous and establish the rotation number in this setting. The essential elements in the proof are linearity and almost periodicity. The future work will be discussed.

The number of traveling wave families in a running water with Coriolis force

朱昊（南京大学）

Abstract：The earth's rotation influences dynamics of large scale flows significantly. As indicated by J. Pedlosky, the study of the dynamics of large scale oceanic or atmospheric motions must include the Coriolis force to be geophysically relevant, and once the Coriolis force is included a host of subtle and fascinating dynamical phenomena are possible. In this talk, we will discuss the number of traveling wave families near a shear flow under the influence of Coriolis force, where the traveling speeds lie outside the range of the flow. As the Coriolis parameter passes through a certain value, in particular, we will see that the number of traveling wave families changes suddenly from finite one to infinity around a certain shear flow. This indicates that nonlinear long time dynamical behavior around the shear flow is much richer than the non-rotating case, where no such traveling waves exist.