International Workshop on Reaction-Diffusion Models and Mathematical Biology

反应扩散方程与生物数学国际研讨会

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序

册

2009 年 6 月 24-27 日 · 中国 · 哈尔滨

会议地点：

哈尔滨工业大学科学园国际会议中心 210 会议室,
哈尔滨师范大学图书馆报告厅

会议主题：

反应扩散方程模型、生物数学

主办、赞助方：

哈尔滨工业大学数学系

哈尔滨工业大学理学研究中心

哈尔滨师范大学曾远荣泛函分析研究中心

组织者：
刘胜强, 哈尔滨工业大学
史峻平, 美国威廉玛丽学院、哈尔滨师范大学
宋　文, 哈尔滨师范大学
王明新, 东南大学
王玉文, 哈尔滨师范大学
魏俊杰, 哈尔滨工业大学
薛小平, 哈尔滨工业大学

会议工作人员：

史峻平　刘胜强　邢宇明　尹慧英　郭宇潇　赵宇华　崔仁浩　王金凤

王鹏　王金良　王邵凯　方健　苏颖　王春诚　张巍巍　曲颖

会议重要信息

1、 **早餐时间**。入住西苑宾馆代表由宾馆提供早餐，就餐时间为 7：00-8:30。入住哈工大招待所代表早餐自行解决.

2、 **会议交通**。会议大巴早晨发车地点：西苑宾馆；**发车时间：24 日、26 日、27 日**：7:50 am；**25 日**：7:30am(到哈尔滨师范大学)。从西苑宾馆步行到会议地点约需 15 分钟, 路线见附带地图.

3、 **返回西苑宾馆发车地点：晚餐所在餐厅。时间：晚餐后。**

4、 **网络**：西苑宾馆提供网络服务，请向楼层服务员索取网线.

5、 **市内旅游**：26 日下午将组织全体代表参加市内旅游，路线为太阳岛--索菲亚大教堂--中央大街。参加代表敬请**佩戴代表胸卡。**旅游大巴 26 日下午一点从南苑餐厅外出发.

6、 **会后旅游：** 会后将组织邀请报告人和有兴趣的代表于 6 月 28-29 日赴牡丹江市**镜泊湖景区**参观。邀请报告人参观费用由大会承担，其他代表费用 600 元/人(含交通费、餐费、宿费以及景区门票)。
   旅游安排：28 日早餐后自西苑宾馆出发，当日中午抵达镜泊湖景区，28 日下午到 29 日上午为观光时间，29 日下午返回哈尔滨西苑宾馆。

7、 **机票、火车票订票地点：西苑宾馆前台；电话：(0451)86407114**

8、 **离哈信息：邀请报告人**将由会议提供送站服务;接、送站负责人：**王鹏，**电话： 15124522482；
   从哈工大西苑宾馆、哈工大招待所乘坐出租车到**哈尔滨火车站**费用约为 10 元。也可乘 11 路或 64 路、81 路公共汽车到达。

   从哈工大到**哈尔滨机场**乘坐出租车费用约 120 元，耗时约 50 分钟；

   也可乘坐出租车自哈工大到达**民航大酒店**(中山路)、转乘**民航班车**到机场；哈工大到民航大酒店乘坐出租车费用约 15 元，耗时约 15 分钟；自民航大酒店至机场耗时约需 60 分钟，单程票价为 20 元。

9. **会务组：西苑宾馆 XXX 房间, 电话：**

反应扩散方程与生物数学国际研讨会 时间表

6 月 23	6 月 24	6 月 25	6 月 26	6 月 27
全天 报到 地点： 西苑宾馆 大堂	开幕式、邀请报告 08:30--11:45 哈工大国际会议中心 210 室	邀请报告、交流报告 09:00--12:15 哈师大江北校区图书馆报告厅	邀请报告、交流报告 08:30--11:40 哈工大国际会议中心 210 室	邀请报告、交流报告 08:30--12:00 哈工大国际会议中心 210 室
	午餐 12：00--14：00 哈工大南苑餐厅	午餐 12：15--14：00 哈师大桃李园宾馆	午餐 11：40--13：00 哈工大南苑餐厅	午餐 12：00--14：00 哈工大南苑餐厅
	邀请报告,交流报告 14：00--17：50 哈工大科学园国际会议中心 210	邀请报告、交流报告 14：00--17：55 哈师大江北校区图书馆报告厅	太阳岛公园，中央大街，索非亚教堂游览 13：00--17：00	邀请报告、交流报告 14：00--17：50 哈工大科学园国际会议中心 210
晚餐 17：50— 尚居饺子	晚餐 18：00-- 哈工大南苑餐厅	晚宴 18：00-- 八荒通神宾馆	晚餐 17：00-- 哈尔滨马迭尔西餐厅	晚餐 18：00-- 哈工大南苑餐厅

6 月 23 日，星期二，哈尔滨工业大学西苑宾馆

序号	时间	接待人	地点	内容
1	全天	刘胜强 史峻平 等	哈工大西苑宾馆	注册、邀请报告人接站
2	17：50—		尚居饺子馆	全体会议代表晚餐

6 月 24 日，星期三，哈尔滨工业大学科学园国际会议中心 210

序号	时间	主持人	内容	参加人员
3	8:30--8:40	史峻平	校领导、举办单位领导致辞	全体会议代表
4	8:40--8:50			
5	8:50--9:00			
6	9:00--9:15		大会合影 地点： 会议中心一楼入口前	

序号	时间	主持人	报告人	报告题目
7	9:15--10:00	魏俊杰	李树杰	Some remarks on the critical point theory and applications

茶歇 10:00-10:15

序号	时间	主持人	报告人	报告题目
8	10:15--11:00	魏俊杰	杜一宏	On a nonlocal reaction-diffusion problem arising from the modeling of phytoplankton growth
9	11:00--11:45		钟承奎	Exponential attractors for semigroups in Banach spaces

午餐 休息 12:00-14:00 哈工大南苑餐厅

序号	时间	主持人	报告人	报告题目
10	14:00--14:45	赵晓强	蒋继发	Reaction-Diffusion Equations for Two Species Competing for Two Complementary Resources with Internal Storage

| 11 | 14:45--15:30 | | 易英飞 | Quasi-periodic breathers in Hamiltonian networks |

茶歇 15:30-15:45

序号	时间	主持人	报告人	报告题目
12	15:45--16:30	梁 兴	吴建华	Coexistence of Chemostat Model with Diffusion
13	16:30--16:50		孙杰宝	Nonlinear Diffusion Equations and Systems with Periodic Sources
14	16:50--17:10		衣凤岐	Hopf Bifurcation and Steady State Bifurcations in a diffusive bimolecular model with autocatalysis and saturation law
15	17:10--17:30		崔仁浩	Existence and Uniqueness of Positive Solutions for a Class of Semilinear Elliptic Systems
16	17:30--17:50		吴艳霞	一类退化交错扩散方程组带内边界层行波解的存在性

晚餐　　18:00-　　　哈工大南苑餐厅

6 月 25 日，星期四，哈尔滨师范大学图书馆报告厅

序号	时间	主持人	报告人	报告题目
17	9:00--9:45	王明新	楼 元	Evolution of dispersal and ideal free distribution
18	9:45--10:30		李万同	Some Results on Evolution Equations with Nonlocal Delays

茶歇 10:30-10:45

序号	时间	主持人	报告人	报告题目
19	10:45—11:30	周 风	邹幸福	Modeling spatial spread of infectious diseases with a fixed latent period in a spatially continuous domain
20	11:30—12:15		梁 兴	Spreading speed on the periodic cylinder with Dirichlet boundary condition

午餐 休息　　12:15-14:00　　　　哈师大桃李园宾馆

序号	时间	主持人	报告人	报告题目
21	14:00--14:45	吴雅萍	彭　锐	Effect of a Protection Zone in the Diffusive Leslie Predator-prey Model
22	14:45--15:30		李嘉旭	A few models in glucose-insulin regulatory system

茶歇　15:30-15:45

序号	时间	主持人	报告人	报告题目
23	15:45--16:30	彭　锐	任晓锋	Disc droplets, ring droplets, and oval droplets in some morphogenesis and morphology problems
24	16:30--17:15		林支桂	Free boundary problems describing ecological models
25	17:15--17:35		王金凤	Dynamical Analysis for Predator Prey System with Strong Allee Effect
26	17:35--17:55		敖岩岩	稀疏效应下被捕食者种群具有常数投放率的捕食系统定性分析

晚餐　　　18:00-　　　　哈师大八荒通神餐厅

6 月 26 日，星期五，哈工大科学园国际会议中心 210 室

序号	时间	主持人	报告人	报告题目
27	8:30--9:15	杜一宏	阮士贵	Modeling Spatial Spread of Communicable Diseases Involving Animal Hosts
28	9:15--10:00		周　风	Limiting situation for some semilinear elliptic equations

茶歇　10:00-10:15

序号	时间	主持人	报告人	报告题目

29	10:15--11:00	阮士贵	李 亦	Singular Solutions of the Vlasov-Poisson System
30	11:00--11:20		王春程	Global Hopf Bifurcation of a Nicholson's Blowflies Equation of Neutral Type
31	11:20--11:40		苏 颖	一类具时滞的单种群反应扩散模型的 Hopf 分支分析

午餐 休息	11:40-13:00	哈工大南苑餐厅	全体会议代表
市内旅游	13:00-17:00	太阳岛公园， 中央大街， 索非亚教堂	
晚餐	17:00-	马迭尔宾馆西餐厅	全体会议代表

6 月 27 日，星期六，哈工大科学园国际会议中心 210 室

序号	时间	主持人	报告人	报告题目
32	8:30--9:15	李树杰	吴雅萍	Existence and Stability of Steady States and Travelling waves for S-K-T Competition Model with Cross-diffusion
33	9:15--10:00		王明新	Nonlinear Stability of Traveling Wave Fronts for Delayed Reaction Diffusion systems

茶歇 10:00-10:15

序号	时间	主持人	报告人	报告题目
34	10:15--11:00	蒋继发	赵晓强	Spatial Dynamics of A Nonlocal Periodic Reaction-Diffusion Model with Age Structure
35	11:00--11:20		方 健	Monotone Wavefronts for Partially Degenerate Reaction -Diffusion Systems
36	11:20--11:40		张 浩	一类 2 阶差分方程的周期，异宿轨和异宿链的存在性
37	11:40—12:00		郭改慧	The multiplicity and uniqueness for a predator-prey-mutualist model with diffusion

| 午餐 休息 | 12:00-14:00 | 哈工大南苑餐厅 | 全体会议代表 |

序号	时间	主持人	报告人	报告题目
38	14:00--14:45	任晓锋	魏俊杰	Hopf bifurcation for a kind of partial functional-differential equations
39	14:45--15:30		田建军	Mathematical model for emergence of high pathogenicity avian influenza virus from outbreaks with low pathogenicity avian influenza virus H5N2

茶歇 15:30-15:40

序号	时间	主持人	报告人	报告题目
40	15:40--16:25	楼 元	史峻平	Global Bifurcation in reaction-diffusion systems
41	16:25--17:10		许传青	瓣膜置换术中的危险因素分析比较
42	17:10—17:30			
43	17:30--17:50			

晚餐　　18:00-　　哈工大南苑餐厅

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Models and Mathematical Biology

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2009 年 6 月 24-27 日 · 中国 · 哈尔滨
报告摘要

稀疏效应下被捕食者种群具有常数投放率的捕食系统定性分析

敖岩岩

哈尔滨理工大学

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Abstract: 本文考虑稀疏效应下被捕食者种群具有常数投放率的捕食系统。利用微分学相关理论及定性分析方法，讨论系统正平衡点的全局稳定性，极限环的存在性和唯一性。

Existence and Uniqueness of Positive Solutions for a Class of Semilinear Elliptic Systems

崔仁浩

哈尔滨师范大学

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Abstract: In this talk, we consider existence and uniqueness of positive solutions for a class of semilinear elliptic systems. Our main result is that the existence and uniqueness of positive solution for a class of Lane-Emden type semilinear elliptic systems of three equations. When the nonlinearities functions have a sublinear growth rate, then there exists a positive solution of systems and moreover we prove that with some additional conditions and for the ball domain, the positive solution is unique.

On a nonlocal reaction-diffusion problem arising from the modeling of phytoplankton growth

Yihong Du

University of New England

E-mail: ydu@turing.une.edu.au

Abstract: We analyze a nonlocal reaction-diffusion model which describes the competition of phytoplankton species for light with incomplete mixing in a water column. First we establish the global stability for the single population growth. Then we study the two species competition model and establish the uniform persistence. (This is a joint work with Prof. Sze-Bi Hsu of National Tsinghua Univ.)

Monotone Wavefronts for Partially Degenerate Reaction-Diffusion Systems

Jian Fang

Dept. of Mathematics , Harbin Institute of Technology

Email: jfang@mun.ca

Abstract: In this talk, I will report our recent work on monotone wavefronts for cooperative and partially degenerate reaction-diffusion systems. The existence of monostable wavefronts is established via the vector-valued upper and lower solutions method. It turns out that the minimal wave speed of monostable wavefronts coincides with the spreading speed. The existence of bistable wavefronts is obtained by the vanishing viscosity approach combined with the properties of spreading speeds in monostable cases. This is a joint work with Dr. Xiaoqiang Zhao.

The multiplicity and uniqueness for a

predator-prey-mutualist model with diffusion

郭改慧

陕西师范大学数学与信息科学院

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In this paper, a predator-prey-mutualist model with diffusion is considered. The sufficient conditions of the existence for positive steady state solutions are first established mainly using the developed degree theory. And the multiplicity is derived under the assumption that β is suitably large. In addition, a good understanding of the existence, uniqueness and stability of positive steady state solutions is gained when γ is large enough. At last, we present some numerical simulations that verify and complement the analytic results in one dimensional case.

Reaction-Diffusion Equations for Two Species Competing for Two

Complementary Resources with Internal Storage

Jifa Jiang

Shanghai Normal University

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Abstract: In this paper, we use reaction-diffusion equations to construct a mathematical model for two species competing for two complementary resources with internal storage in an unstirred chemostat. The conservation principles are used to reduce the dimension of our system by eliminating the equations for the nutrients. The reduced system (limiting system) generates a strongly monotone dynamical system in its feasible domain under a suitable partial order. This reduced system contains two invariant subsystems which are sublinear but have a singularity at the origin. We construct suitable upper, lower solutions, together to the sublinearity of these two invariant subsystems, to establish the existence of positive steady-state solutions.

Given the parameters of the reduced system, we answer the basic questions as to which species survives and which does not in the spatial environment and determine the global behaviors. The sufficient conditions, via species' intrinsic biological characteristics, the external environment forces and the principal eigenvalues of some scalar partial differential equations are given to conclude that the extinction, competitive exclusion and persistence. This is a joint work with Prof. Hsu. Sze-Bi and Dr. Wang Fengbin.

A few models in glucose-insulin regulatory system

Jiaxu Li

Dept. of Mathematics, University of Louisville

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Abstract: Diabetes mellitus has been defined as an epidemic disease in regarding to the life style. Both diabetic population and medical expenses are increasingly growing. Many researchers have put great efforts in understanding how the system works, what are the causes to make the system dysfunctional, how to detect the onset of diabetes, and how to provide more efficient, effective and economic treatment to the disease. In this talk, several mathematical models in this system are summarized and discussed. These include modeling the ultradian oscillation of insulin secretion, modeling the intravenous glucose tolerance test (IVGTT), and modeling the subcutaneous injection of insulin analogues.

Some remarks on the critical point theory and applications

Shujie Li

Harbin Normal University

E-mail: lisj@math.ac.cn

Abstract: In this talk we will give some remarks on the following problems:

(1) Splitting theorem in C^{2-0} case.

(2) Poincare-Hopf theorem for C^1 case.

(3) Splitting theorem at infinity and resonant problems.

(4) Robin boundary value problem.

Some Results on Evolution Equations with Nonlocal Delays

Wan-Tong Li

School of Mathematics and Statistics, Lanzhou University

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Abstract: Diffusion systems with nonlocal delays arise naturally from physics, ecology, epidemiology and materials science, and can more precisely describe some realistic phenomena. Recently, this field has been extensively studied by many authors such as H. Berestycki, P. C. Fife and H.F. Weinberger and so on. It is an

important and interesting subject to establish a systemical theory with respect to the diffusion systems with nonlocal delays. Generally speaking, the interaction of spatial nonlocal effect and time delay can produce many difficulties which cannot be overcome by ordinary methods and need new ideas and techniques. In this talk, we will report our results on traveling wave solutions and entire solutions to reaction-diffusion systems with nonlocal delays (joint with Guo Lin, Nai-Wei Liu, Shigui Ruan, Zhi-Cheng Wang and Jianhong Wu).

Singular Solutions of the Vlasov-Poisson System

Yi Li
University of Iowa
Email: yli@math.uiowa.edu

Abstract: In this talk we study the positive singular solutions $\phi = \phi(r)$ of the differential equation

$$\phi'' + \frac{2}{r}\phi' = -\frac{r^{\lambda-2}}{(1+r^2)^{\lambda/2}}\phi^p, \qquad p > 1, \ \lambda > 1,$$

on their maximal intervals of the positive real line $\mathbb{R}^+$ and the corresponding system for "Flat" Galaxy. For $\lambda = 2$, these solutions are the radial solutions of the semilinear elliptic equation

$$\Delta\phi = -\frac{1}{1+x^2}\phi^p,$$

on $\mathbb{R}^3$, which T. Matukuma proposed in 1935 for the description of certain stellar globular clusters in a steady state. They correspond to time-independent solutions of the Vlasov-Poisson system

$$(V) \qquad \partial_t f + v\partial_x f - \partial_x U(t,x)\partial_v f = 0$$
$$(P) \qquad \Delta U(t,x) = 4\pi\rho(t,x)$$
$$(D) \qquad \rho(t,x) := \int f(t,x,v)\,dv, \qquad x,v \in \mathbb{R}^3,$$

in the case of spherical symmetry; here $f = f(t,x,v) \geq 0$ is the distribution function of the considered system of gravitating mass in the space-velocity space $\mathbb{R}^3 \times \mathbb{R}^3$, $t \geq 0$ the time, $U = U(t,x)$ the Newtonian potential and $\rho = \rho(t,x)$ the local density.

Spreading speed on the periodic cylinder with Dirichlet boundary condition

Xing Liang
Chinese Univ. Sci. & Technology
E-mail: xliang@ustc.edu.cn

Abstract: In this talk, I will introduce our work on Spreading speed of a reaction-diffusion equation on the periodic cylinder with Dirichlet boundary condition.

Free boundary problems describing ecological models

林支桂

扬州大学数学科学学院
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Abstract: This talk is concerned with a system of semilinear parabolic equations with a free boundary, which arises in a mutualistic ecological model. The local existence and uniqueness of a classical solution are obtained. The asymptotic behavior of the free boundary problem is studied. Our results show that the free problem admits a global slow solution if the inter-specific competitions are strong, while if the inter-specific competitions are weak there exist the blowup solution and global fast solution.

Evolution of dispersal and ideal free distribution

Yuan Lou

Ohio State University

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Abstract: A general question in the study of the evolution of dispersal is what kind of dispersal strategies can convey competitive advantages and thus will evolve. We consider a two species competition model in which the species are assumed to have the same population dynamics but different dispersal strategies. Both species disperse by random diffusion and advection along certain gradients, with the same random dispersal rates but different advection coefficients. We found a conditional dispersal strategy which results in the ideal free distribution of species, and show that it is a local evolutionarily stable strategy. We further show that this strategy is also a global convergent stable strategy under suitable assumptions, and our results illustrate how the evolution of conditional dispersal can lead to an ideal free distribution. The underlying biological reason is that the species with this particular dispersal strategy can perfectly match the environmental resource, which leads to its fitness being equilibrated across the habitats. This is a joint work with Steve Cantrell and Chris Cosner.

Effect of a Protection Zone in the Diffusive Leslie Predator-prey

Model

Rui Peng

School of Science & Technology, University of New England

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Abstract: In this talk, we consider the diffusive Leslie predator-prey model with large intrinsic predator growth rate, and investigate the change of behavior of the model when a simple protection zone Ω_0 for the prey is introduced. We show the existence of a critical patch size of the protection zone, determined by the first Dirichlet eigenvalue of the Laplacian over Ω_0 and the intrinsic growth rate of the prey, so that there is fundamental change of the dynamical behavior of the model only when Ω_0 is above the critical patch size. However, our research here reveals significant difference of the model's behavior from the predator-prey model studied in [Y. Du and J. Shi, A diffusive predator-prey model with a protection zone, J. Diff. Eqns., 229(2006), 63-91.] with the same kind of protection zone. We show that the asymptotic profile of the population distribution of the Leslie model is governed by a standard boundary blow-up problem, and classical or degenerate

logistic equations. This is a joint work with Prof. Yihong Du and Prof. Mingxin Wang.

Disc droplets, ring droplets, and oval droplets in some morphogenesis and morphology problems

Xiaofeng Ren

George Washington University

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Abstract: The Gierer-Meinhardt system for morphogenesis in development and the Ohta-Kawasaki theory for block copolymer morphology give rise to one nonlocal geometric problem of finding a (often disconnected) subset of a given domain. The subset satisfies an equation that involves the curvature of the boundary of the subset and the inverse Laplacian of the characteristic function of the subset. Three solutions are found: a subset of many small discs, a subset of many small rings, and a small oval shaped subset. A resonance diagram determines the existence and stability of the first two solutions. It reveals a complicated landscape of the free energy functional. An analysis near a resonance point yields the third solution with unexpected properties.

Modeling Spatial Spread of Communicable Diseases Involving Animal Hosts

Shigui Ruan

University of Miami

E-mail: ruan@math.miami.edu

Abstract: In this talk, we review some previous studies on modeling spatial spread of specific communicable diseases using reaction-diffusion equations. Selected topics include the transmission of rabies in fox population, dengue, West Nile virus, hantavirus spread in mouse population, Lyme disease, and feline immunodeficiency virus(FIV). (Based on a joint paper with Jianhong Wu)

Global bifurcation and dynamics of CIMA chemical reaction model

史峻平

College of William and Mary

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Abstract: The first experimental observation of a Turing pattern in a chemical reaction occurred in a chlorite-iodide-malonic acid (CIMA) reaction in 1990, Lengyel and Epstein simplified the reaction mechanism and proposed a reaction-diffusion model for CIMA reaction. Global bifurcations of stationary patterns and time-periodic patterns for CIMA reaction model are described. In particular the existence of spatial-dependent periodic orbits are shown. Similar results also hold for other chemical reaction systems which possess activator-inhibitor structure and

homogeneous limit cycles.

一类具时滞的单种群反应扩散模型的 Hopf 分支分析

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Abstract: 这个报告是关于一个一般的平均增长率为一个时间延迟项的反应扩散种群模型的讨论。其中的平均增长率可以是 Logistic 的或者是弱 Allee 的。通过对特征方程的分析和应用隐函数定理，得到了正稳态解的稳定性，并且以时滞为参数得到了正稳态解附近的 Hopf 分支的存在性及分支方向。得到的一般结果被应用到一个"food-limited"种群模型和一个具弱 Allee 效应的种群模型。这个工作是与魏俊杰教授和史峻平教授合作完成的。

Nonlinear Diffusion Equations and Systems with Periodic Sources

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Abstract: In this monograph, we consider nonlinear diffusion equations and systems with periodic sources. We mainly study the non-Newtonian polytropic filtration equation with logistic periodic sources, the weakly coupled non-Newtonian polytropic filtration system with periodic sources. Our interest lies in the existence of nontrivial nonnegative periodic solutions and asymptotic behavior of nonnegative solutions of the initial boundary problem.

Global Hopf Bifurcation of a Nicholson's Blowflies Equation of Neutral Type

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Abstract: We investigate Hopf bifurcations in a delayed Nicholson's blowflies equation of neutral type, derived from the Gurtin-MacCamy model. A key parameter that determines the direction of the Hopf bifurcation and the stability of the bifurcating periodic solutions is derived. Global extension of local Hopf branches is established by combining a global Hopf bifurcation theorem with a Bendixson criterion for higher dimensional ordinary differential equations.

Nonlinear Stability of Traveling Wave Fronts for Delayed Reaction Diffusion systems

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Abstract: This paper is concerned with nonlinear stability of traveling wave fronts for delayed reaction diffusion system. We prove that the traveling wave front is exponentially stable to perturbation in some exponentially weighted L^∞ spaces, when the difference between initial data and traveling wave front decays exponentially as $x\rightarrow-\infty$, but the initial data can be arbitrary large in other locations. Moreover, the time decay rates are obtained by weighted energy estimates.

Dynamical Analysis for Predator Prey System with Strong Allee Effect

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Abstract: In this talk, we study the qualitative properties of a predator prey system with strong Allee effect subject to the homogeneous Neumann boundary condition. By a comparison argument, we prove that the asymptotic behavior of spatially inhomogeneous solutions and further explain the threshold .We also investigate the local existence of homogeneous and inhomogeneous periodic solutions depending on Hopf bifurcation theorem of reaction diffusion system. Moreover, we also establish the existence and nonexistence of nonconstant positive steady states (stationary patterns) by use of a priori estimates and the steady state bifurcation.

Mathematical model for emergence of high pathogenicity avian influenza virus from outbreaks with low pathogenicity avian influenza virus H5N2

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Abstract: In this article, we establish a mathematical model for emergence of high pathogenicity avian influenza (HPAI) viruses from outbreaks of low pathogenicity avian influenza (LPAI) A viruses (H5N2). The model is based on traditional mathematical epidemiology models and experiment evidences. It contains several sub-models that are traditional SEIR models or SIR models. The experimental data from Central Institute for Animal Disease Control at Netherland provides information about LPAI and HPAI virus transmission characters and evidence of double infection. Double infection means HPAI viruses can infect animals that are infected by LPAI viruses. We analyze our model and their sub-models. We also carry out comparisons between model predictions and experimental data, and we answer several important biological questions with our model.

Hopf bifurcation for a kind of partial functional-differential equations

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Abstract: In this paper, we extend the computation of the properties of Hopf bifurcation, such as the direction of bifurcation and stability of bifurcating periodic solutions, of DDE introduced by Kazarinoff et al [J. Inst. Math. Appl, 21 (1978) 461-477] to a kind of partial functional-differential equations(PFDE). As an example, a delayed diffusive Nicholson's blowflies equation is considered, and the explicit formulas for determining the direction of bifurcation and the stability of bifurcating periodic solutions are derived.

Coexistence of Chemostat Model with Diffusion

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Abstract: In this talk, the coexistence state of chemostat model with diffusion is given, and the related result is also surveyed if possible. Some simulations are also done to complement the mathematical analysis. The main ingredients include the global bifurcation theory, the fixed point index theory, the perturbation method and simulations. This is a joint work with G.Wolkowicz, H.Nie, G.H.Guo

Existence and Stability of Steady States and Travelling waves for

S-K-T Competition Model with Cross-diffusion

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Abstract: This talk is concerned with the following Shigesada-Kawasaki-Teramoto competition model with cross diffusion

$$\begin{cases} u_t = d_1[(1+\gamma_1 v)u]_{xx} + (a_1 - b_1 u - c_1 v)u \\ v_t = d_2[(1+\gamma_2 u)v]_{xx} + (a_2 - b_2 u - c_2 v)v \end{cases} \quad (1)$$

here $d_1, d_2 > 0, \gamma_i \geq 0,$ and $a_i, b_i, c_i > 0, i = 1, 2.$ We shall talk about some recent results on the existence and stability of nonconstant steady states with special structure and travelling waves with transition layers when one of the cross diffusion parameters γ_1 or γ_2 is not small.

一类退化交错扩散方程组带内边界层行波解的存在性

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Abstract: 本文主要研究了一类带有小参数的具有交错扩散项的反应扩散方程组的带内边界层行波解的存在性. 对方程组

$$\begin{cases} u_t = \varepsilon^2 (u^2)_{xx} + f(u,v) \\ u_t = [(1+\varepsilon\gamma u)v]_{xx} + g(u,v), \end{cases} \quad x \in R$$

其中, u,v 表示两种生物种群的密度, 非齐次项 f,g 的一般形式为:

$$f(u,v) = uf_1(u,v), g(u,v) = vg_1(u,v)$$

此模型包含两个重要的特例: 竞争模型和捕食模型. 我们利用基于隐函数定理的奇异摄动方法并借助于中心流形定理,证明了当 $S(\beta^*) > 0$ 时, 其波速为 $c(\varepsilon)\varepsilon$ 的行波解的存在性, 这里 $S(\beta^*) \equiv \int_0^{h(\beta^*)} 2sf(s,\beta^*)ds$. 从而把 Y.Hosono 的无交错扩散项的结果推广到了有交错扩散项的情形.

瓣膜置换术中的危险因素分析比较

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Abstract: 心血管疾病是临床上最常见的疾病之一，它已成为威胁人类生命安全的最严重的因素之一。而人工心脏瓣膜置换术是临床上最重要的治疗方法之一。中国科学院北京阜外心血管医院是中国最大的心血管疾病医院,在多年的手术过程中，他们积累了大量病人的术前和术后身体状况与治疗手段的数据。通过建立回归分析以及 Cox 分析模型，我们得到：1. 和近期死亡有关的因素是：病因，二尖瓣病理，主动脉瓣病理，其它心血管疾病，入院心功能，主动脉阻断时间，环缩二尖瓣瓣环类型，原瓣种类，术后射血分数，术后并发症，转机时间。其中心血管疾病中的房缺，PDA，入院心功能 III-IV 级，主动脉阻断时间在 61－90 分钟，出现环缩的二尖瓣瓣环类型为 Devega 环，术后射血分数在 25％——35％ 之间，二尖瓣术后超生结果为瓣周漏为高度危险因素。即出现以上症状的患者具有很高的死亡风险。2. 和远期死亡有关的因素是：糖尿病，射血分数，主动脉阻断时间，年龄。其中患有糖尿病史，术后射血分数小于 35％，主动脉阻断时间在 61－90 分钟，患者年龄小于 15 岁和大于 65 岁为高度危险因素。

Hopf Bifurcation and Steady State Bifurcations in a diffusive bimolecular model with autocatalysis and saturation law

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Abstract: We consider the possibility of Hopf bifurcations and steady state bifurcations for a kind of diffusive bimolecular model with autocatalysis and saturation law. Our results suggest the existence of spatially non-homogenous periodic orbits and non-constant positive steady state solutions. Numerical examples are presented to support our theoretical analysis.

Quasi-periodic breathers in Hamiltonian networks

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Hamiltonian networks form an important class of infinite dimensional Hamiltonian systems arising in solid state physics, cell biology, and many other areas of science and technology. They also arise naturally in the discretization of Hamiltonian PDEs but the physical interest in Hamiltonian networks mainly lies in dynamics which are far away from those of Hamiltonian PDEs. Among interesting dynamics of a Hamiltonian network, of physical importance is a robust coherent structure known as breathers or quasi-periodic breathers which are self-localized, time periodic or quasi-periodic solutions. In this lecture, several models of Hamiltonian networks of long-range, weakly coupled anharmonic oscillators will be considered. It will be shown that corresponding to any fixed number of sites in such a Hamiltonian network, there is a positive Lebesgue measure set of linear stable, quasi-periodic breathers with the number of oscillating frequencies equal to the number of excited sites. This is a joint work with Jiansheng Geng and Jorge Viveros.

一类 2 阶差分方程的周期轨，异宿轨和异宿链的存在性

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Abstract: 本文研究一类 2 阶离散周期 Hamiltonian 系统 $\Delta^2 q(t-1) + V'(q(t)) = 0$ 的周期轨，异宿轨和异宿链的存在性. 利用 Ljusternik-Schnirelmann 畴数理论和 Morse 理论,本文证明了该系统存在多重周期解；利用极小化方法，本文证明了对 V 的任一最大值点 β 该系统存在多条连接 β 与 V 的其他最大值点的异宿轨,并且对 V 的任意两个最大值点,该系统存在连接这两个点的异宿链.

Spatial Dynamics of A Nonlocal Periodic Reaction-Diffusion Model

with Age Structure

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Abstract: In this talk, I will report our recent research on a nonlocal periodic reaction-diffusion population model with age structure. In the case of unbounded spatial domain, we establish the existence of the asymptotic speed of spread and show that it coincides with the minimal wave speed for monotone periodic traveling waves. In the case of bounded spatial domain, we obtain a threshold result on the global attractivity of either zero or a positive periodic solution. This is a joint work with Dr.

Yu Jin [SIAM J. Math. Anal., 40(2009), 2496-2516].

Exponential attractors for semigroups in Banach spaces

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Abstract:

Let $\{S(t)\}_{t \geqslant 0}$ be a semigroup on a Banach space X, and $\mathscr{A}$ be the global attractor for $\{S(t)\}_{t \geqslant 0}$.

We assume that $\{S(t)\}_{t \geqslant 0}$ is of class C^1 on a bounded absorbing set $B_{\epsilon_0}(\mathscr{A})$ and, furthermore, the linearized operator L at each point of $B_{\epsilon_0}(\mathscr{A})$ can be decomposed as $L = K + C$ with K compact and $\|C\| < \lambda < 1$, then we prove the existence of exponential attractor in the Banach space X. Here $B_{\epsilon_0}(\mathscr{A})$ denotes the ϵ_0-neighborhood of $\mathscr{A}$, $\|C\|$ denotes the norm of the operator C.

As an application, we prove the existence of exponential attractor for some nonlinear reaction-diffusion equations with polynomial growth nonlinearity of arbitrary order.

Limiting situation for some semilinear elliptic equations

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Abstract: In this talk, we will discuss the limiting situation for some nonlinear eigenvalue problems. For superlinear case, we focus on the regularity of extremal solution. For singular nonlinearity case, as the MEMS equations, we study the global existence of the corresponding parabolic equation and the finite time blow up phenomenon. An anisotropic Louisville type equation with bubbling solutions are also discussed.

Modeling spatial spread of infectious diseases with a fixed latent period in a spatially continuous domain

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Abstract: In this paper, with the assumptions that an infectious disease in a population has a fixed latent period and the latent individuals of the population may diffuse, we formulate an SIR model with a simple demographic structure for the population living in a spatially continuous environment. The model is given by a system of reaction-diffusion equations with a discrete delay accounting for the latency and a spatially non-local term caused by the mobility of the individuals during the latent period. We address the existence, uniqueness and positivity of solution to the initial-value problem for this type of system. Moreover, we investigate the traveling wave fronts of the system and obtain a critical value c^* which is a lower bound for the wave speed of the traveling wave fronts. Although we cannot prove that this value is exactly the minimal wave speed, numeric simulations seem to suggest that it is. Furthermore, the simulations on the PDE model also suggest that the spread speed of the disease indeed coincides with c^*. We also discuss how the model parameters affect c^*.