



Qingdao, Shandong, China

Workshop on Differential Equations and Application



College of Science
China University of Petroleum (East China)
July 16-17, 2016

Workshop on Differential Equations and Application

2016. 07. 16–17

Organizer:

China University of Petroleum (East China)

Organizing Committee:

Tasawar Hayat: Quaid-i-Azam University, Pakistan

Daqing Jiang, Weiguo Li, Hui Guo: China University of Petroleum (East China), China

Conference Secrety:

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Conference Venue:

On July16—17, the workshop will be held in in Yellow Sea Hall on 1 F of Blue Horizon Marina Gold Hotel(蓝海金港大饭店一楼黄海厅)near China University of Petroleum .

Meals:

1. In room 102 on 1 F of Blue Horizon Marina Gold Hotel
(就餐地点: 蓝海金港大饭店一楼 102 包间)
2. Lunch time:12:00;Supper time:18:00

Friday, July15, 14:00—21:00

Registration Day (Blue Horizon Marina Gold Hotel)

Program

Saturday, July 16, 2016

Time	Chair	Speaker	Title
8:00-8:30			Registration
8:30-9:10	Weiguo Li 李维国		Opening ceremony, group photo
9:10-9:50	Weiguo Li 李维国	Prof.Dr. Tasawar Hayat	Art of mathematical modeling and peristalsis

9:50-10:10 Tea Break			
10:10-10:50	Junjie Wei 魏俊杰	Xilin Fu 傅希林	Flow Switchability in Discontinuous Dynamical Systems with Applications
10:50-11:30		Daxiong Piao 朴大雄	Boundedness for the General Semilinear Duffing Equations via the Twist Theorem
11:30-12:00		Yuguo Lin 林玉国	Stationary distribution of a stochastic SIS epidemic model with standard incidence
12:00-14:00 Lunch			
14:00-14:40	Xilin Fu 傅希林	Junjie Wei 魏俊杰	Bifurcation analysis of a general reaction-diffusion equation with delays
14:40-15:20		Xianyi Li 李先义	Singular orbits and bifurcations of three hyperchaotic systems
15:20-16:00		Xiaohua Ding 丁效华	
16:00-16:20 Tea Break			
16:20-16:40	Daxiong Piao 朴大雄	Liang Wang 王靓	The periodic solutions of a stochastic chemostat model with periodic washout rate
16:40-17:00		Chunyan Ji 季春燕	Threshold behaviour of stochastic SIR models
17:00-17:20		Li Zu 祖力	Study on the stationary distributions and periodic solutions of stochastic predator-prey models
17:20-17:40		Jing Fu 付静	Dynamical behavior of a stochastic ratio-dependent predator-prey system with Holling type IV

			functional response
17:40-18:00		Liya Liu 刘丽雅	The threshold of stochastic chemostat model with Monod-Haldene response function
18:00 Dinner			

Sunday, July 17, 2016

Time	Chair	Speaker	Title
8:00-8:40	Xianyi Li 李先义	Jingli Ren 任景莉	先进材料塑性研究中的数学方法
8:40-9:10		Hui Guo 郭会	Local discontinuous Galerkin method for incompressible miscible displacement problem in porous media
9:10-9:40		Liping Gao 高理平	Energy Identities of Maxwell Equations With Periodic Boundary and Their Applications in the ADI-FDTD Methods
9:40-10:10		Ben Niu 牛犇	On a Kuramoto Model with Time Delay and Distributed Shear
10:10-10:30 Tea Break			
10:30-10:50	Dejun Fan 范德军	XinhongZhang 张新红	Survival analysis of a stochastic SIS epidemic model with saturated incidence rate and double epidemic diseases
10:50-11:10		Yan Li 李燕	Dynamics of a diffusive prey-predator model with modified Leslie-Gower term and Michaelis-Menten type prey harvesting
11:10-11:30		Yuxiao Guo 郭宇潇	Amplitude death and spatiotemporal bifurcations in nonlocally delay-coupled oscillators
11:30-11:50		Chengjun Yuan 苑成军	Two positive solutions for (n-1,1)-type semipositone integral boundary value problems for coupled systems of nonlinear fractional differential equations
12:00-14:00 Lunch			
14:00 Tour (Golden Sands Beach, 金沙滩)			
18:00 Dinner			

Abstract of Talks

1.

Art of mathematical modeling and peristalsis

Tasawar Hayat

Quaid-i-Azam University

Abstract: Here various steps involved in process of mathematical modeling will be pointed out. Compounding treat in mathematical modeling will be discussed. Mechanism of peristaltic transport of material deviating Newton's law of viscosity will be formulated in a planer channel. Constitutive equations for generalized second order material will be utilized in the formulation. Magnetohydrodynamic concepts through laws of electromagnetism will be employed. Whole analysis will be studied in a wave frame of reference. Stream function formulation will be followed. Nonlinear problem subject to long wavelength approximation will be numerically solved. Besides the several physical quantities, the pumping and trapping phenomena will be analyzed in detail. Outcome of present material will be compared with previous studies and analyzed in physiological relevance.

2.

Flow Switchability in Discontinuous Dynamical Systems with Applications

Xilin Fu

Shandong Normal University

Abstract: In this talk, the switchability of a flow to the boundary of two distinct dynamical systems is discussed in discontinuous dynamical systems. The switching bifurcations between the passable and non-passable flows are presented. The dynamics of an inclined impact oscillator under periodic excitation are investigated using the flow switchability theory of the discontinuous dynamical systems. This is a joint work with Yanyan Zhang.

3.

Boundedness for the General Semilinear Duffing Equations via the Twist Theorem

Daxiong Piao

Ocean University of China

Abstract: We consider the boundedness of all solutions for the

periodic semilinear equation

$$x'' + \omega^2 x + \psi(x, t) = p(t)$$

where $\psi(x, t)$ does not necessarily satisfy the so called polynomial-like growth condition:

$$\lim_{|x| \rightarrow \infty} x^m \psi^{(m)}(x, t) = 0$$

for some finite m . Usually this condition is needed in the references about boundedness problems of semilinear Duffing equations. Two cases of resonance and non-resonance are considered respectively.

* Joint work with Yiqian Wang, Zhiguo Wang, LeiJiao and Xiao Ma
4.

Stationary distribution of a stochastic SIS epidemic model with standard incidence

YuGuo Lin

Beihua University

Abstract: In this talk, we consider a stochastic SIS epidemic model with perturbed disease transmission coefficient. Since the diffusion matrix is degenerate, we must adopt Markov semigroup theory to study the Markov process governed by SDE. We prove that if $\mathcal{R}_0 < 1$, the disease will tend to zero in probability; whereas if $\mathcal{R}_0 > 1$, the densities of the distributions of the solution can converge in L^1 to an invariant density, and also we find the support of the invariant density. This result can provide a deep insight into the dynamics of stochastic models.

5.

Bifurcation analysis of a general reaction-diffusion equation with delays

Junjie Wei

Harbin Institute of Technology

Abstract: In this talk, we consider the dynamics of a type of general reaction-diffusion equation with delays, which includes diffusive Nicholson's blowflies model, diffusive Mackey-Glass equation, diffusive Lasota-Ważewska model, etc. The stability of the positive

steady state and the existence of Hopf bifurcation are investigated by analyzing the distribution of eigenvalues. The properties of Hopf bifurcation are determined by the normal form theory and center manifold reduction for partial functional differential equations. And global existence of periodic solutions is established by using the global Hopf bifurcation result of Wu. Finally, some numerical simulations are carried out to illustrate the analytical results. This is joint work with Xiaofeng Xu.

6.

Singular orbits and bifurcations of three hyperchaotic systems

Xianyi Li

Yangzhou University

Abstract: In this talk, one considers the rich dynamics of three new hyperchaotic systems, mainly for the existence and nonexistence of homoclinic and heteroclinic orbits, and the existence of singularly degenerate heteroclinic cycles.

7.

8.

The periodic solutions of a stochastic chemostat model with periodic washout rate

Liang Wang

Northeast Normal University

Abstract: Real environments are far from being homogeneous, either in space or in time. There are both seasonal and random effects caused by variable climate. The chemostat is a basic piece of laboratory apparatus used for the continuous culture of microorganisms. It is natural working with a chemostat with periodic washout rate. While the ecosystem dynamics is also inevitably affected by environmental white noise which is an important component in real applications. Even though the experimental results observed in well-controlled laboratory conditions match closely the deterministic theoretical behavior, we cannot ignore the difference that may occur in operational conditions. In this talk, we will make the first attempt to fill this gap. The white noise is incorporated through the effect of randomly fluctuating environment to model the stochastic chemostat system with periodic washout

rate. By constructing a suitable Lyapunov function, we establish the sufficient conditions for the existence of the stochastic nontrivial periodic solutions for the system, on the basis of Khasminskii's theory on periodic Markov processes. Furthermore, we observe that there exists a unique boundary periodic solution of the stochastic model which is globally attractive. Under the same conditions, the microorganisms will go to extinct exponentially almost surely. The global dynamics of deterministic and stochastic chemostat model are investigated by numerical simulations which illustrate our main conclusions clearly.

9.

Threshold behaviour of stochastic SIR models

Chunyan Ji

Changshu Institute of Technology

Abstract: In this topic, we investigate the threshold behaviour of susceptible-infected-recovered (SIR) epidemic models with different stochastic perturbations. We obtain the threshold for these models which determines the extinction and persistence of the epidemic. Compared with the corresponding deterministic system, this value is affected by white noise, which is less than the basic reproduction number of the deterministic system. This implies that the large noise will also suppress the epidemic to prevail, which never happens in the deterministic system. Besides, for the model with periodic coefficients, we show the existence of the periodic solutions. At last, these results are illustrated by computer simulations.

10.

Study on the stationary distributions and periodic solutions of stochastic predator-prey models

Li Zu

Hainan Normal University

Abstract: In this report, we will introduce a stochastic Lotka–Volterra predator–prey model with regime switching. We examine when the system is persistence in mean and the extinction under some appropriate conditions, and we discuss the threshold between them. Sufficient conditions for the stationary distribution which is ergodic and positive recurrent of the solution is established using stochastic Lyapunov functions. In addition, a stochastic non-autonomous Lotka-Volterra predator-prey model with periodic

coefficients will be introduced. We prove that there exists at least one positive periodic solution by using the theory of Has'minskii, and obtain sufficient conditions for persistence in mean and extinction for the stochastic non-autonomous system. Simulations are also carried out to illustrate our analytical results.

11.

Dynamical behavior of a stochastic ratio-dependent predator-prey system with Holling type IV functional response

Jing Fu

Changchun Normal University

Abstract: In this paper, we investigate the dynamical properties of a stochastic ratio-dependent predator-prey system with Holling type IV functional response. The global existence of a positive unique solution to the system with positive initial value is shown employing comparison theorem of stochastic equation and Itô's formula. We derived some sufficient conditions for the persistence in mean and extinction. This system has a stable stationary distribution which is ergodic. Numerical simulations are carried out for further support of present research.

12.

The threshold of stochastic chemostat model with Monod-Haldene response function

Liya Liu

China University of Petroleum (East China)

Abstract: This paper considers the a stochastic chemostat model with Monod-Haldene response function. We show the condition for the microorganism to be extinct. Moreover, we prove the system has a stationary distribution and derive the expression for its invariant density.

13.

先进材料塑性研究中的数学方法

Jingli Ren

Zhengzhou University

摘要: 这里我们运用数学方法探讨材料在外场作用下的塑性变形所对应的物理机制, 将混沌分形、渗流、微分方程等理论应用于材料

塑性锯齿流的动力学分析。

14.

Local discontinuous Galerkin method for incompressible miscible displacement problem in porous media

Hui Guo

China University of Petroleum (East China)

Abstract: We develop local discontinuous Galerkin method for the coupled system of incompressible miscible displacement problem. Optimal error estimates for c and velocity u are derived. The main techniques in the analysis include the treatment of the inter-element jump terms which arise from the discontinuous nature of the numerical method, the nonlinearity, and the coupling of the models. Numerical experiments are shown to demonstrate the theoretical results.

15.

Energy Identities of Maxwell Equations With Periodic Boundary and Their Applications in the ADI-FDTD Methods

Liping Gao

China University of Petroleum(East China)

Abstract: In this paper new energy identities of the three dimensional (3D) Maxwell equations in a cubic domain filled by a lossy medium and covered with periodic boundary are proposed.

The identities expressed in the form of H^1 and H^2 norms reflect a new kind of energy conservation for electromagnetic fields. By these energy identities several modified energy identities of the alternating direction implicit finite difference time domain (ADI-FDTD) method for the 3D Maxwell equations are derived and unconditional stability in the discrete H^1 and H^2 norms is then proved. By error estimates it is proved that the ADI-FDTD method is of second order accuracy and super convergence in the discrete H^1 and H^2 norms. Experiments are provided and computational results confirm the analysis on energy conservation, stability and super convergence.

16.

On a Kuramoto Model with Time Delay and Distributed Shear

Ben Niu

Harbin Institute of Technology

Abstract: Time delay effect and distributed shear are both considered in the Kuramoto model. On the Ott- Antonsen's manifold, the stability boundary of incoherent state is derived in multiple-parameter space. Moreover, very rich dynamical behavior such as stability switches inducing synchronization switches can occur in this equation. On one hand, theoretical analysis indicates that the spread of shear and time delay can both eliminate the synchronization then lead the Kuramoto model to incoherence. On the other, delay can induce several coexisting coherent states.

17.

Survival analysis of a stochastic SIS epidemic model with saturated incidence rate and double epidemic diseases

Xinhong Zhang

China University of Petroleum (East China)

Abstract: This paper is concerned with a stochastic SIS epidemic model with saturated incidence rate and double epidemic diseases which makes the research more complex. Firstly we obtain sufficient conditions for the extinction and persistence in the mean of two epidemic diseases. Furthermore, we prove that the two diseases can coexist under appropriate conditions. Finally, numerical simulations are introduced to illustrate the results developed.

18.

Dynamics of a diffusive prey-predator model with modified Leslie-Gower term and Michaelis-Menten type prey harvesting

Yan Li

China University of Petroleum (East China)

Abstract: A diffusive prey-predator model with modified Leslie-Gower term and Michaelis-Menten type prey harvesting is concerned. The content is divided in to several parts: (1) Coexistence of steady states for the model subject to the homogeneous Dirichlet boundary condition;(2) Hopf bifurcation of the model subject to the homogeneous Neumann boundary condition with prey harvesting and time delay as Hopf bifurcation parameter respectively.

19.

**Amplitude death and spatiotemporal bifurcations in
nonlocally delay-coupled oscillators**

Yuxiao Guo

Harbin Institute of Technology

Abstract: Amplitude death and spatiotemporal oscillations are remarkable patterns in coupled systems. We consider a ring of n identical oscillators with distance- dependent couplings and time delay. The amplitude death region is the intersection of three stable regions. Employing the method of multiple scales and normal form theory, the stability and criticality of spatiotemporal oscillations are determined. Around the amplitude death boundary there exist one branch of synchronized oscillations, $n-3$ branches of co-existing phase-locked oscillations, n branches of mirror-reflecting oscillations, n branches of standing- wave oscillations, one branch of quasiperiodic oscillations and two branches of co-existing synchronized oscillations. It is proved that amplitude death is robust to small inhomogeneity of couplings, and the stability of synchronized or phase-locked oscillations inherits that of the individual decoupled oscillator. For the arbitrary form of coupling functions, some general results are also obtained for the thermodynamic limit. Finally, two examples are given to support the main results.

20.

**Two positive solutions for $(n-1,1)$ -type semipositone integral
boundary value problems for coupled systems of nonlinear
fractional differential equations**

Chengjun Yuan

Harbin University

摘要: 研究了一类半正的分式阶微分方程组边值问题解的存在性,利用不动点定理,给出了其存在两个正解的充分条件.