第五届国际生物数学与医学应用研讨会

The 5th International Symposium on Biological Mathematics and Medical Applications

（2024.5.24-26 | Nanjing, China）

Program

主办单位:

南京信息工程大学 (NUIST)

加拿大约克大学疾病建模中心 (CDM)

江苏省工业与应用数学学会 (JSIAM)

目 录

Announcement (English version)

The 5th International Symposium on Biological Mathematics and Medical Applications

The **Nanjing University of Information Science and Technology** (NUIST) is proud to announce that we will be hosting the **5th International Symposium on Biological Mathematics and Medical Applications**. This symposium will provide an international forum for interdisciplinary experts to present their latest research findings, share innovative ideas, identify challenges and opportunities, and promote international collaborations in biological mathematics and medical applications. It will also provide an excellent opportunity for young researchers and students to interact with our leading scientists and learn hands-on research experience in these fields.

This International Symposium is jointly hosted by **Nanjing University of Information Science and Technology**, **Centre for Disease Modelling (CDM)** of **York University**, and **Jiangsu Society for Industrial and Applied Mathematics (JSIAM)**. It is one of the important activities of the Science and Technology Activity Month of NUIST, and will be held on May 24-26 (Beijing Time: UTC+8) in the form of a series of specialized topics.

Register in advance: https://docs.qq.com/form/page/DU2dQQUdFRkxjYUNp

▪ Time and place

1. Time
Check-in time: 14:00-21:00 on May 24, 2024
Check-in place: Nanqi Hotel, NUIST
2. Place of Symposium: Meteorological Building (May 25) & Mingde Building (May 26)
3. Place of Accommodation: Nanqi Hotel & Xingcheng Hotel

▪ Contact Information

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▪ Sponsors

Nanjing University of Information Science and Technology (NUIST), China
Centre for Disease Modelling (CDM), York University, Canada
Jiangsu Society for Industrial and Applied Mathematics (JSIAM), China

第五届国际生物数学与医学应用研讨会

（第三次通知）

为促进生物数学、微分方程及医学应用等方向的交叉研究与发展，增强国内外同行专家的学术交流与合作，拓展和提高相关领域青年教师和研究生的学术视野和研究水平，由**南京信息工程大学、加拿大约克大学疾病建模中心 (CDM)、江苏省工业与应用数学学会**联合主办，**中国数学会生物数学专业委员会**协办，**南京信息工程大学数学与统计学院、江苏省工业与应用数学学会数学生命科学专委会**承办的“第五届国际生物数学与医学应用研讨会”将于 2024 年 5 月 24 日至 26 日在**中国南京**举行。

欢迎生物数学及生物医学领域的专家学者和研究生踊跃参加。

一、会议时间与地点

1. 会议时间

报到时间：2024 年 5 月 24 日 14:00—21:00

报到地点：南气宾馆（南京信息工程大学盘新路入口，高德地图：南气宾馆西北门；百度地图：南京信息工程大学-北 2 门）

会议时间：2024 年 5 月 25 日至 26 日

2. 会议地点：南京市宁六路 219 号 南京信息工程大学气象楼（25 日会议）、明德楼（26 日会议）

3. 住宿地点：

南气宾馆，房价：326 元起/间/天（标间/大床房，含早）；

星程酒店（南京信息工程大学地铁站店），地址：南京市浦口区杨新路 1 号，房价：普通间 219 元起/间/天（含早）、豪华间 254 元起/间/天（含早）；

注：会议期间，如有交通等因素的特殊需求，可代为预定南京市区如下协议价酒店

华东饭店（地址：南京市北京西路 67 号，房价：D 楼单早 380 元起/间/天、B 楼单早 440 元起/间/天）

二、会议内容

会议围绕“生物学中的数学问题及其在医学中的应用”展开，主要包括但不限于如下内容：种群动力学、数学生态学、传染病与公共健康、计算系统生物学、复杂疾病的数学建模、人工智能与数据建模等。

三、会议注册安排

1. 会议报告及注册：参会人员请根据下列方式之一注册；报告语言为汉语/英语，请有意作报告的老师或同学于 2024 年 4 月 30 日前完成报告题目、摘要等信息的填写。

（1）网址填写： https://docs.qq.com/form/page/DU2dQQUdFRkxjYUNp

（2）二维码填写：

注册二维码

缴费二维码

2. 会议微信群：为方便通知与联系，请注册后添加微信：18745746090 加入本次会议微信群。

3. 会议注册费：

4 月 13 日~5 月 18 日期间缴费：教师 1000 元/人，研究生（需持有效证件）600 元/人；

5 月 19 日（含）以后及会议现场：因会期正值南京旅游旺季，住房非常紧张，原则上将不再提供住宿及注册安排。

4. 食宿费：

会议统一安排食宿，交通费及食宿费用自理，会议无伙食补贴。

5. 会务费缴费方式：

（1）二维码缴费（**优先推荐**）：

请您通过支付宝扫描上方二维码；若您所在单位要求通过公务卡对公支付注册费，请您提前在支付宝绑定公务卡后再进行二维码扫码支付。

（2）银行对公转账：

户名：南京信息工程大学

银行账号：10115401040000228

开户行：中国农业银行股份有限公司南京盘城支行

银行对公转账请务必备注：“单位名称+姓名+生物数学会务费”，并将转账凭证发送至邮箱：anqi@nuist.edu.cn 或微信：18745746090.

注：（1）缴费为一人一缴；

（2）发票类型为电子发票，开具后将直接发送链接到缴费预留手机号。

四、乘车路线

1. **南京禄口机场至南京信息工程大学路线：**

（1）乘坐地铁 S1 号线至南京南站转地铁 3 号线至泰冯路站转地铁 S8 号线至南京信息工程大学站下，全程约 2 小时。

（2）乘坐出租车或网约车（约 170 元），全程约 1 小时 10 分钟。

2. **南京南站至南京信息工程大学路线：**

（1）乘坐地铁 3 号线至泰冯路站转地铁 S8 号线至南京信息工程大学站下，全程约 1 小时 10 分钟。

（2）乘坐出租车或网约车（约 85 元），全程约 50 分钟。

3. **南京站至南京信息工程大学路线：**

（1）乘坐地铁 3 号线至泰冯路站转地铁 S8 号线至南京信息工程大学站下，全程约 50 分钟。

（3）乘坐出租车或网约车（约 45 元），全程约 35 分钟。

五、会议联系人

1. 南京信息工程大学

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南京信息工程大学数学与统计学院

江苏省工业与应用数学学会数学生命科学专委会

2024 年 5 月 20 日

Schedule

May 24, Friday Afternoon (Beijing time: UTC+8)

Registration and Check-in

Time	Place	Chair
14:00-21:00	Building 1, Nanqi Hotel (南气宾馆), NUIST	Qi An (安琪)
18:30-20:00 Dinner		

May 25, Saturday Morning (Beijing time: UTC+8)

Lecture Hall, 1st Floor, Meteorological Building
(气象楼一楼报告厅)

Opening Ceremony

Time	Items	Chair
08:00-08:40	· Welcome speech · Group photo	Wenjun Liu (刘文军)

Invited Talks

Time	Speaker	Institution	Title	Chair
08:40-09:20	Pierre Auger	French Academy of Sciences, France	Effect of environmental heterogeneity on the increase in Maximum Sustainable Yield (MSY)	Huaiping Zhu (朱怀平)
09:20-10:00	Jane Heffernan	York University, Canada	In-host Models for SARS-CoV-2 Infection and Vaccination	
10:00-10:20 Break				
10:20-11:00	Shigui Ruan (阮士贵)	University of Miami	Single Species Population Models with Harvesting and Gompertz Tumor Model with Periodical Treatment	Assefa Woldegerima
11:00-11:40	Junjie Wei (魏俊杰)	Harbin Institute of Technology (哈尔滨工业大学)	Dynamics of reaction-diffusion mussel-algae system	Xingwang Xu (徐兴旺)
12:00-13:00 Lunch				

May 25, Saturday Afternoon (Beijing time: UTC+8)

Invited Talks

Lecture Hall, 1st Floor, Meteorological Building (气象楼一楼报告厅)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
14:00-14:40	Sanyi Tang (唐三一)	Shanxi University (山西大学)	Universal model, generalization and application of drug toxicological effects (药物毒理效应的普适性模型、推广及应用)	Yong Jiang (蒋勇)
14:40-15:20	Zhigui Lin (林支桂)	Yangzhou University (扬州大学)	Domain evolution and impulsive harvesting in the diffusive logistic model	Jun Yu (余军)
15:20-15:40 Break				

Group A

Lecture Hall, 1st Floor, Meteorological Building (气象楼一楼报告厅)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
15:40-16:10	Yuan Yuan (袁沅)	Memorial University of Newfoundland, Canada	Pattern Formation in Mathematical Biology	Shengqiang Liu (刘胜强)
16:10-16:40	Daihai He (何岱海)	The Hong Kong Polytechnic University (香港理工大学)	The 1978 English Boarding School Influenza Outbreak: Where the Classic Seir Model Fails	
16:40-17:10	Tianran Zhang (张天然)	Southwest University (西南大学)	Dynamics of predator-prey model with fear effect and patch structure (具有恐惧效应及斑块结构的捕食者-食饵模型动力学)	

Group B

Room 423, 4th Floor, Meteorological Building (气象楼 423 会议室)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
15:40-16:10	Kaifa Wang (王开发)	Southwest University (西南大学)	A dynamic model of chronic HBV infection based on molecular biological mechanisms and clinical data (基于分子生物学机制和临床数据的慢性 HBV 感染动力学模型)	Weiming Wang (王玮明)
16:10-16:40	Yueping Dong (董岳平)	Central China Normal University (华中师范大学)	Delay induced rich dynamics of tumor-immune system models	
16:40-17:10	Haitao Song (宋海涛)	Shanxi University (山西大学)	Is there a risk of Chikungunya autochthonous transmission and outbreak in Ontario, Canada?	

Discussion

17:15 Gather at the north of the Meteorological Building and take the bus to Jianshan Garden (在气象楼北门集中，乘坐巴士去见山园)

17:20-17:50 Visit the Jianshan Garden (见山园)

17:50 Gather at the Jianshan Garden and take the bus to the dinner venue (在见山园集中，乘坐巴士去晚餐地点)

18:30-20:00 Dinner

May 26, Sunday Morning (Beijing time: UTC+8)

Invited Talks

Room 115, 1st Floor, North District of Mingde Building (明德楼北区 115)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:00-08:40	Wei Lin (林伟)	Fudan University (复旦大学)	Rhythm regulation of complex living systems (复杂生命系统的节律调控)	Wenjun Liu (刘文军)

Group A Modeling of mosquito-borne infectious diseases (蚊媒传染病建模)

Room 115, 1st Floor, North District of Mingde Building (明德楼北区 115)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:15	Xianghong Zhang (张香红)	Southwest University (西南大学)	Modeling the spread of Wolbachia in wild mosquitoes with birth-pulse and insecticide impulsive spraying	Shujing Gao (高淑京)
09:15-09:40	Juan Li (李娟)	Zhejiang Sci-Tech University (浙江理工大学)	A two-stage model with distributed delay for mosquito population dynamics	
09:40-10:05	Guanghu Zhu (祝光湖)	Guilin University of Electronic Technology (桂林电子科技大学)	Expression of mosquito-borne ecological parameters based on meteorological factors and their impact on mosquito-borne infectious diseases (基于气象因素的蚊媒生态参数表达式及对蚊媒传染病的影响)	
10:05-10:25 Break				
10:25-10:50	Chenxia Lei (类成霞)	Jiangsu Normal University (江苏师范大学)	Diffusive SIS Epidemic Models with Nonlinear Incidence Functions in a Heterogeneous Environment	Zhipeng Qiu (邱志鹏)
10:50-11:15	Kaihui Liu (刘凯慧)	Jiangsu University (江苏大学)	Effectiveness evaluation of mosquito suppression strategies on dengue transmission under changing temperature and precipitation	
11:15-11:40	Kai Wang (王凯)	Guangzhou University (广州大学)	Threshold dynamics of a mosquito-borne disease model with chemotaxis and spatial heterogeneity	

Group B Infectious diseases and public health (传染病与公共健康)

Room 109, 1st Floor, North District of Mingde Building (明德楼北区 109)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:15	Fengying Wei (魏凤英)	Fuzhou University (福州大学)	Truncated E-M Method for Stochastic L-V Competition Models	Jie Gao (高洁)
09:15-09:40	Qun Liu (刘群)	Northeast Normal University (东北师范大学)	Analysis of a Stochastic Within-Host Model of Dengue Infection with Immune Response and Ornstein-Uhlenbeck Process	
09:40-10:05	Peng Wu (吴鹏)	Hangzhou Dianzi University (杭州电子科技大学)	PrEP Intervention in the Mitigation of HIV/AIDS Epidemics in China via a Data-Validated Age-Structured Model	
10:05-10:25 Break				
10:25-10:50	Konstantin AVILOV	The Hong Kong Polytechnic University (香港理工大学)	COVID-19 vaccination effectiveness on population level: inconsistency in key studies	Hui Wan (万辉)
10:50-11:15	Jie Bai (白洁)	Liaoning University (辽宁大学)	A Mechanistic Model for Long COVID Dynamics	
11:15-11:40	Ting Guo (郭婷)	Changzhou University (常州大学)	Modeling HIV persistence and viral rebound	Zhenguo Bai (白振国)
11:40-12:05	Qi An (安琪)	Nanjing University of Information Science and Technology (南京信息工程大学)	Normal form and Hopf bifurcation for the memory-based reaction-diffusion equation with nonlocal effect	

Group C Population dynamics (种群动力学)

Room 108, 1st Floor, North District of Mingde Building (明德楼北区 108)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:15	Ben Niu (牛犇)	Harbin Institute of Technology at Weihai (哈尔滨工业大学（威海）)	Turing-Hopf Interaction on a Circular Domain	Weihua Jiang (蒋卫华)
09:15-09:40	Daifeng Duan (段代凤)	Nanjing University of Posts and Telecommunications (南京邮电大学)	The dynamical analysis of a nonlocal predator-prey model with cannibalism	
09:40-10:05	Zhongcai Zhu (朱忠才)	Guangzhou University (广州大学)	Dynamics of a time-switched model with Ricker-type survival probability	
10:05-10:25 Break				
10:25-10:50	Min Zhu (朱敏)	Anhui Normal University (安徽师范大学)	Dynamics of population models in evolutionary regions (演化区域中的种群动力学)	Ranchao Wu (吴然超)
10:50-11:15	Jingnan Wang (王晶囡)	Harbin University of Science and Technology (哈尔滨理工大学)	Dynamics of lung cancer model and influence factors of lung cancer	
11:15-11:40	Xuebing Zhang (张学兵)	Nanjing University of Information Science and Technology (南京信息工程大学)	Dynamics analysis of non-smooth diffusive population model	

Group D Modeling and Data Analysis (建模与数据分析)

Room 105, 1st Floor, North District of Mingde Building (明德楼北区 105)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:15	Hao Kang (康浩)	Tianjin University (天津大学)	Global dynamics and spreading speeds of a diffusive age-structured model	Maoxing Liu (刘茂省)
09:15-09:40	Xiaoli Wang (王小利)	Southwest University (西南大学)	Hopf bifurcation in a reaction-diffusion-advection model with nonlocal delay effect and Dirichlet boundary condition	
09:40-10:05	Linhe Zhu (朱霖河)	Jiangsu University (江苏大学)	Dynamic analysis and parameter identification of network spatiotemporal evolution model	Youhui Su (苏有慧)
10:05-10:25 Break				
10:25-10:50	Yiwen Tao (陶亦文)	Zhengzhou University (郑州大学)	Exploring Spatiotemporal Patterns of Algal Cell Density in Lake Dianchi with Explainable Machine Learning	Youhui Su (苏有慧)
10:50-11:15	Yadong Liu (刘亚东)	Nanjing Normal University (南京师范大学)	A Diffuse Interface Model of Fluid-Structure Interactions for Blood Flows and Thrombus	Xianyi Li (李先义)
11:15-11:40	Kewang Chen (陈克旺)	Nanjing University of Information Science and Technology (南京信息工程大学)	Anderson acceleration for gradient-enhanced PINN with application in blood flow simulation	

May 26, Sunday Morning (Beijing time: UTC+8)

Graduate Students Forum (研究生论坛)

Group E

Room 104, 1st Floor, North District of Mingde Building (明德楼北区 104)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:05	Yanning An (安雁宁)	Nanjing University of Information Science and Technology (南京信息工程大学)	Atherosclerosis models based on fluid-structure interaction and reaction-diffusion	Yanchong Xu (徐衍聪)
09:05-09:20	Yi Ding (丁一)	Jiangsu University (江苏大学)	Modeling the effects of awareness and information diffusion on green behavior spreading in multiplex networks	
09:20-09:35	Xingyu Bo (薄鑫宇)	Nanjing University of Information Science and Technology (南京信息工程大学)	Optimal harvest control of predator-prey systems in fisheries with stage structure and additional food supply	
09:35-09:50	Li Miao (缪力)	Jiangsu University (江苏大学)	Parameter identification of a reaction-diffusion predator-prey system based on optimal control theory	
09:50-10:05	Jinshan Wang (王金山)	Nanjing University of Aeronautics and Astronautics (南京航空航天大学)	Analysis of a degenerate reaction-diffusion anthrax model with spatial heterogeneity	
10:05-10:25 Break				
10:25-10:40	Yun Li (李云)	Nanjing University of Aeronautics and Astronautics (南京航空航天大学)	Modeling mosquito control by an impulsive reaction-diffusion model on a periodically evolving domain	Canrong Tian (田灿荣)
10:40-10:55	Jiaxin Zhao (赵嘉欣)	Zhengzhou University (郑州大学)	Exploring the impact of socioeconomic and natural factors on pulmonary tuberculosis incidence in China (2013-2019) using explainable machine learning: A nationwide study	

10:55-11:10	Yuhui Sun (孙玉慧)	Nanjing University of Information Science and Technology (南京信息工程大学)	Optimal placement of marine protected areas for a predator-prey fish model	
11:10-11:25	Bingxin Li (李冰鑫)	Jiangsu University (江苏大学)	Study on the complex dynamics of green behavior spreading on large-scale heterogeneous networks	
11:25-11:40	Jie Zhang (张洁)	Nanjing University of Information Science and Technology (南京信息工程大学)	The horizontal magnetic primitive equations approximation of the anisotropic MHD equations in a thin 3D domain	

Group F

Room 101, 1st Floor, North District of Mingde Building (明德楼北区 101)				
Time	**Speaker**	**Institution**	**Title**	**Chair**
08:50-09:05	You Zhou (周游)	Yangzhou University (扬州大学)	Dynamical behavior of the fecal-oral transmission diseases model on a T-periodic evolution domain	Xinyou Meng (孟新友)
09:05-09:20	Xiaoyue Yuan (原晓月)	Nanjing University of Information Science and Technology (南京信息工程大学)	Sustainable management of predatory fish affected by an Allee effect through marine protected areas and taxation	
09:20-09:35	Cheng Chu (储成)	Nanjing University of Information Science and Technology (南京信息工程大学)	Optimal harvest for predator-prey fishery models with variable price and marine protected area	
09:35-09:50	Yuxuan Pan (潘雨轩)	Jiangsu University (江苏大学)	Research and application of ecological green behavior based on network reaction-diffusion system (基于网络反应扩散系统的生态绿色行为研究及应用)	
09:50-10:05	Yongqing Zhao (赵永庆)	Nanjing University of Information Science and Technology (南京信息工程大学)	Time periodic weak solution to incompressible generalized newtonian fluid with an elastic plate	

10:05-10:25 Break				
10:25-10:40	Jing Wang (王敬)	Nanjing University of Aeronautics and Astronautics (南京航空航天大学)	Threshold dynamics and regional optimal control of a malaria model with spatial heterogeneity and ivermectin therapy	Juan Zhang (张娟)
10:40-10:55	Yonglin Chen (陈永琳)	Nanjing University of Information Science and Technology (南京信息工程大学)	Stability analysis of an atherosclerotic plaque formation model with time delay	
10:55-11:10	Zidie Zhang (张子蝶)	Anqing Normal University (安庆师范大学)	Predator invasion in a spatially heterogeneous predator-prey model with group defense and prey-taxis	
11:10-11:25	Sensen Wang (王森森)	Nanjing University of Information Science and Technology (南京信息工程大学)	An optimized AdaBoost algorithm with atherosclerosis diagnostic applications: adaptive weight-adjustable boosting	
11:25-11:40	Qiang Fu (付强)	Nanjing University of Information Science and Technology (南京信息工程大学)	Delayed Feedback Control for the Consensus and Average Quasi-Consensus of Delayed Second-order Multi-agent Systems	
12:00-13:00 Lunch				
Free discussion Return trip				

Abstract

(Alphabetic order)

Normal form and Hopf bifurcation for the memory-based reaction-diffusion equation with nonlocal effect

Qi An

Nanjing University of Information Science and Technology, China

In this paper, we provide the normal form for the Hopf bifurcation of a class of the reaction-diffusion equation with memory-based diffusion and nonlocal effect, where the delay is present in the differential term, similar to the chemotaxismodel with time delay. The eigenvalue problems and the decomposition of the phase space are discussed in detail. Through a series of variable transformations, we obtain the third-order truncated normal form of the model constrained on the central manifold and its equivalent equation in polar coordinates. Then, with the help of the dynamic analysis for the finite dimensional equations, the key parameters for determining the direction and stability of the Hopf bifurcation are given. These theoretical results are applied to the Bazykin's model, the stability, Turing bifurcation and Hopf bifurcation of the equilibrium are demonstrated through both theoretical and numerical methods.

Biography: 安琪，南京信息工程大学数学与统计学院讲师，硕士生导师。研究方向为微分方程稳定性理论及分支理论。相关成果主要发表在 Journal of Differential Equations、Ecological Modelling、Discrete and Continuous Dynamical Systems 等期刊。现主持国家自然基金青年基金、江苏省自然科学基金等项目。

Effect of environmental heterogeneity on the increase in Maximum Sustainable Yield (MSY)

Pierre Auger

UMI IRD 209 UMMISCO, Bondy, France

We consider a fishery consisting of two fishing sites connected by fish migrations. At each site we assume the classic fishery model with a logistically growing fish population and Schaefer catch. We assume that migrations between the two sites are fast relative to local growth and fishing. Taking advantage of the time scales, we use methods of aggregation of variables to obtain a reduced model governing the total biomass of the fish population at a slow time scale. Then, we are looking for the maximum sustainable yield (MSY) for the system of the two connected patches. We show that although the total equilibrium population may be greater than the sum of the carrying capacities on each isolated site, the total catch is always less than or equal to the sum of the catches on the isolated fishing sites. We then consider a Lotka-Volterra prey-predator fish community in the same environment. We assume that only the predator is caught and not its prey, still growing logistically on each site. We show that in this case due to connectivity the total catch at MSY can be greater than the sum of the captures on each isolated site. This last result is held

when the two sites are heterogeneous. Two heterogeneity parameters are important, the growth rate of the prey and a parameter characterizing the viability of the predator. It appears that the prey growth rate has to be large at one site while the predator viability has to be high at the other site in order to promote excess MSY. Furthermore, an emergence phenomenon can also be observed: even if none of the sites is viable for fishing, the entire system can be viable. Our study is extended to the prey-predator model with a type II Holling functional response.

Biography: Pierre Auger is a member of the French Academy of Sciences. His research field concerns the mathematical modeling of biological systems. He has developed an original approach to the integration of the organizational levels of these complex systems, which allows numerous applications, in agronomy or in medicine for example. In order to avoid the difficulties caused by a large number of variables and parameters in the process of model analysis, he presents a novel mathematical method to establish a simplified model according to the time scales of the processes occurring in different levels of biological system. They are mainly methods of aggregation of variables in dynamic systems. These methods were applied by Pierre Auger to the dynamics of populations and communities for the consideration of individual behaviors in population models and for the description of the spatial dynamics of a population in heterogeneous environments. In addition, he has also established mathematical models for the propagation of the depolarization wave in the ventricular wall of the heart and multiple problems in the thiofs fisheries. More recently, Pierre Auger has worked on modeling in epidemiology, more specifically on the effects of non-pharmaceutical protection and containment measures on the dynamics of the Covid-19 epidemic.

A Mechanistic Model for Long COVID Dynamics

Jie Bai

Liaoning University, China

Long COVID, a long-lasting disorder following the acute infection of COVID-19, represents a significant public health burden at present. In this paper, we propose a new mechanistic model based on differential equations to investigate the population dynamics of long COVID. By connecting long COVID with the acute infection at the population level, our modeling framework emphasizes the interplay between COVID-19 transmission, vaccination, and long COVID dynamics. We conduct a detailed mathematical analysis for the model. We also validate the model with numerical simulation using real data from the US state of Tennessee and the UK.

Biography: 白洁，博士，发表传染病方向 SCI 论文多篇，主持中国工业与应用数学学会女性应用数学支持研究项目，主持省级科研项目2项，主持省级教育科学和教学改革项目4项。

Anderson acceleration for gradient-enhanced PINN with application in blood flow simulation

Kewang Chen

Nanjing University of Information Science and Technology, China

In this talk, we adopt a Physics-Informed Neural Network (PINN) framework for blood flow simulation. To address the strong nonlinear convection term in the Navier-Stokes equations, we first introduce a gradient and Hessian-enhanced PINN. To accelerate the training process, Anderson acceleration is employed to enhance traditional optimization methods such as Adam, SGD, and LBFGS. Finally, numerical results demonstrate the effectiveness of our proposed methodology.

Biography: 陈克旺，南京信息工程大学，讲师。博士毕业于美国佛蒙特大学，荷兰代尔夫特理工大学博士后。主要研究偏微分方程理论分析与数值计算；以及加速算法及其在等几何分析、深度学习中的应用。已主持完成国家自然科学基金青年基金等项目。

The 1978 English Boarding School Influenza Outbreak: Where the Classic Seir Model Fails

Daihai He

The Hong Kong Polytechnic University, China

Previous work has failed to fit classic epidemic models satisfactorily to the prevalence data of the famous English boarding school 1978 influenza A/H1N1 outbreak during the children's pandemic. We built a susceptible (S) - exposed (E) - infectious (I) - confined to bed (B) - convalescent (C) - recovered (R) model with time delay in E and I compartments and multistage in B and C compartments. We simultaneously fitted the reported B and C prevalence curves as well as the attack rate (proportion of children infected during the outbreak). The model is based on delay differential equations and dummy subgroups to reproduce the non-exponential residence times, which was crucial for good fits. The estimates of the generation time and the basic reproductive number (R0) appear to be biologically reasonable. Our model has laid a base for further studies.

Biography: Dr He is an Associate Professor of the Department of Applied Mathematics at The Hong Kong Polytechnic University. He earned a Ph.D. in Engineering from Xi'an Jiaotong University in 1999 and a Ph.D. in Mathematics from McMaster University in Canada in 2006. He also did post-doctoral research in Beijing Normal University (China), University of Michigan (USA), and Tel Aviv University (Israel). His main research interests are infectious disease modelling and statistical analysis of medical data. More than 140 papers have been published in journals such as PNAS, Science Advances, Annals of Internal Medicine, European Respiratory Journal, Journal of the Royal Society Interface. According to Stanford University report, Dr He is among top 2% scientists in 2021 and 2022.

In-host Models for SARS-CoV-2 Infection and Vaccination

Jane Heffernan

York University, Canada

Mathematical models of the cellular, vaccine, and virus dynamics in-host can be used to gain understanding in the infection process leading to mild, moderate, or severe infections, quantify the development of immunity post-infection and vaccination, and determine the probability that a

new variant can be developed that can transmit and infect a secondary host. In this talk, we will review mathematical models that we have developed to study these outcomes. Model results will be presented and will be discussed in terms of extensions to public health epidemiology modelling and parameterization.

Biography: Jane Heffernan is a Professor and York Research Chair in Modelling Infection & Immunity (MI2) in the Mathematics & Statistics Department and Canadian Centre for Disease Modelling (CCDM) at YorkU. Heffernan has over 100 publications and an h-index of 32. Dr Heffernan currently serves as President of the international Society for Mathematical Biology (SMB), a co-Director of the Canadian Centre for Disease Modelling (CCDM), co-Lead of the Canadian Immunization Research Network Modelling Network (CIRN-ModERN), Scientific Advisor to the COVID Immunity Task Force (CITF), and she leads national and international research groups in Mathematical Immunology and Immunity Modelling, including the Canadian In-host Working Group (CIWG), and a National Research Council (NRC) Pandemic Response Challenge Program (PRCP) COVID-19 Vaccine modelling team. She has also served on the Boards of the Canadian Applied and Industrial Mathematics Society (CAIMS) and SMB. Heffernan recently completed modelling advisor roles to Health Canada's COVID Task Force and Ontario's Public Health Emergencies Science Advisory Committee (OPHESAC). Heffernan is a member of the Public Health Agency of Canada (PHAC) External Experts Modelling Group, Canadian COVID-19 Modelling Task Force, Mathematics for Public Health network (MfPH), One Health Network for Modelling Emerging Infections (OMNI-REUNI), Technology Enhanced Biopharmaceutical Development research network (TenBioDev), CIRN, and an Industrial Research Chair network with Sanofi Pasteur. She has also led the OMNI-REUNI training program, and is a YorkU Polaris EDI Champion (developing training videos for EDI practice for hiring committees, award adjudication, etc). Heffernan is an SMB Fellow and is a Member of the Royal Society of Canada (RSC) College of New Scholars, Artists and Scientists.

Global dynamics and spreading speeds of a diffusive age-structured model

Hao Kang

Tianjin University, China

In this paper, we consider an age-structured population dynamics model with spatial diffusion in the spatially periodic media. First, we give a complete characterization of the global dynamics for the problem via investigating the existence, uniqueness and stability of a nontrivial equilibrium. Next, we establish the spatial propagation dynamics for the problem and derive the formula for the asymptotic speed of spreading. Our approach is to develop the theory of generalized principal eigenvalues and the homogenization method via overcoming some new challenges arising from the nonlocal age boundary condition. This is a joint work with Shuang Liu.

Biography: 康浩，天津大学应用数学中心讲师。2013年本科毕业于兰州大学，2020年博士毕业于美国迈阿密大学，随后在法国诺曼底勒阿弗尔大学做博士后。2022年7月在天津大学应用数学中心工作。主要研究微分方程和动力系统及其在生物数学中的应用。在Math. Ann.、Israel J. Math.、 J. Anal. Math. 、SIAM J. Math. Anal.、Calc. Var. Partial Differential

Equations、J. Differential Equations 等学术期刊发表若干文章。

COVID-19 vaccination effectiveness on population level: inconsistency in key studies

Konstantin AVILOV

The Hong Kong Polytechnic University, China

The number of deaths averted by the COVID-19 vaccination campaign can be estimated only by mathematical modelling: by comparing the factual scenario with vaccination and a model-predicted scenario without vaccination. Many articles estimating COVID-19 vaccine effectiveness (VE) have been published. They relied on very different modelling approaches and produced very divergent VE estimates. We analysed 30 papers including highly cited works by Watson et al. and Suthar et al., compared them to our previous estimates (He et al.), and supplemented them with our regression model on the USA county-level data (close to Suthar et al.'s approach).The very sophisticated model by Watson et al. gave systematically much higher estimates of deaths averted as compared to other works: 0.5-0.6% of the USA population vs. 0.15-0.2% in most other studies. Our in-depth analysis revealed both realistic features of Watson et al.'s model (age-structured epidemiology, "elderly first" vaccination, healthcare overload effects) and "problematic" features (substantial immunity loss for the Alpha and Delta variants, possible overfitting due to overly flexible time-dependent infection transmission rate, 45% increase in fatality rate for the Delta variant). Yet, the main problem was that Watson et al.'s model did not reproduce the trends observed in the county-level USA data.Regression models on subnational-level data (including Suthar et al. and our regression) employ "natural experiments", and so they use much fewer assumptions and appear to be more reliable. The VE estimates from them are in line with the majority of other purely model-based studies. Conclusion: Population-level epidemiological models need to be verified against lower-level data. USA VE estimates of 0.15-0.2% appear to be more correct.

Biography: Konstantin AVILOV is a Research Associate at the Department of Applied Mathematics of the Hong Kong Polytechnic University. He received his PhD from Marchuk Institute of Numerical Mathematics of the Russian Academy of Sciences (Moscow, Russia) in 2007 and is working in the field of mathematical epidemiology and mathematical modelling.

Diffusive SIS Epidemic Models with Nonlinear Incidence Functions in a Heterogeneous Environment

Chengxia Lei

Jiangsu Normal University, China

We consider two SIS epidemic reaction-diffusion models with nonlinear incidence functions, and study the global stability of the endemic equilibrium in homogeneous environment, and explore the asymptotic profiles of the endemic steady state for (large or small) diffusion rates in the spatially heterogeneous environment. The talk is based on joint works with several collaborators: Prof. Daozhou Gao (Cleveland State University,USA), Prof. Rui Peng (Zhejiang

Normal Univ), Dr. Yachun Tong (Changzhou Institute of Technology) and Benben Zhang (Jiangsu Normal Univ).

Biography: 类成霞，江苏师范大学数学统计学院，副教授，曾获得江苏省优秀硕士论文称号；分别主持国家自然科学基金和江苏省自然科学基金青年项目各一项；主要从事于偏微分方程在生物数学上的应用方面的研究，研究成果分别发表在 Sci. China Math., J. Differential Equations, J. Dynam. Differential Equations, Discrete Contin. Dyn. Syst. Ser. B 等期刊上 20 余篇。

A two-stage model with distributed delay for mosquito population dynamics

Juan Li

Zhejiang Sci-Tech University, China

Understanding mosquito population dynamics is essential for controlling mosquito-borne diseases. For investigating the driving role and mechanism of temperature on the production of mosquitos, we propose a mathematical model using distributed delay differential equations with age structure of aquatic and adult stages. By defining the reproduction number, we present analytical results on equilibrium stability, and further study the bifurcations and dynamics of the model with two popularly used delay kernels. I will present some simulations to illustrate how the temperature and maturation time affect the population dynamics of the mosquitoes.

Biography: 李娟，浙江理工大学计算科学与技术学院(人工智能学院)讲师，特聘副教授，硕士生导师，博士毕业于南京师范大学，曾公派加拿大 York University 数学与统计学院访学，博士后出站于中国动物卫生与流行病学中心。研究兴趣主要有：微分方程和动力系统理论及其在种群生态和流行病防控中的应用；数据驱动的传染病建模与仿真研究，大数据和人工智能在人畜共患病建模与防控的应用，预警模型和风险评估与预报。目前主持国家自然科学基金青年项目 1 项，参与省级和国外合作项目各 1 项，以第一作者/共同第一作等身份在 Bulletin of the World Health Organization，SIAM Journal on Applied mathematics、Transboundary and Emergence Disease 等国际重要期刊上发表 SCI 收录论文 10 余篇。

Rhythm regulation of complex living systems (复杂生命系统的节律调控)

Wei Lin

Fudan University, China

复杂生命系统中普遍存在周期性波动的运动行为。这些振荡信号通过适当的频率和振幅参与生命功能编码，保持生命系统的韧性稳定。充分了解生命振荡的定量机理、准确调控频率振幅、甚至人工创造特定的遗传振荡器对生命健康至关重要。为此，需结合生物实验大数据和数理逻辑与方法进行定量化、理论化、系统化的研究。主要可从以下三个角度对其中亟需解决的科学问题进行探索。1）数据驱动：从海量的时空多组学数据中分析总结生命振荡的运动统计规律，挖掘影响振荡调控的关键因素及网络结构，预测振荡发生发展过程及结构变点。2）模型驱动：构建时空动力学模型，系统性地揭示生命振荡的基本定

量原理，建立可靠普适的调控方法，提出新型振荡系统的模块化设计原理。3）智能驱动：融合生物大数据与数学基本原理，利用机器学习方法发展动态化、个性化的精准预测与调控方法、辅助人工生命振荡系统的合成与设计。

Biography: 林伟，复旦大学特聘教授、上海数学中心谷超豪研究所双聘教授、上海人工智能实验室领军科学家。目前，致力于生物数学、计算生物学、复杂系统理论、人工智能数学理论及交叉应用研究。相关成果发表于综合类及应用数学、数学物理、计算生物、自动化领域的顶级期刊和人工智能领域的顶级会议。曾获数学学科国家杰出青年基金、优秀青年基金，获选国家重点研发计划重点项目首席。获得上海市自然科学奖一等奖、V. Afraimovich 奖（非线性物理科学领域杰出青年学者）。现任复旦大学智能复杂体系基础理论与关键技术实验室主任、复旦大学教务处处长。

Domain evolution and impulsive harvesting in the diffusive logistic model

Zhigui Lin

Yangzhou University, China

In order to understand how the combination of domain evolution and impulsive intervention affect the dynamics of a population, we first propose a diffusive logistic population model with impulsive harvesting on a periodically evolving domain. The ecological reproduction index of the impulsive problem is introduced and given by an explicit formula, which depends on the domain evolution rate and the impulsive function, and the threshold dynamics of the population is established based on this index. Secondly, we consider a diffusive logistic population model with impulsive intervention on a domain with moving boundary, spreading and vanishing of the population are discussed. Lastly, we study a diffusive competition model with free boundaries and periodic pulses in a temporally heterogeneous environment with upward or downward advection. The dependence of the principal eigenvalue of corresponding periodic impulsive eigenvalue problem on advection rates, habitat sizes and pulses is investigated, which gives precise conditions that classify the dynamics into four types of competition outcomes including coexistence, co-extinction, two different competition exclusions for small or negative advection rates. Our results not only extend the existing ones to the case with pulses, but also reveal the effects of human and natural factors, that is, impulsive interventions factors including positive or negative impulsive effect, pulse intensity and timing can significantly affect and alter the competition outcomes.

Biography: 林支桂，扬州大学二级教授、博士研究生导师、中国数学会生物数学专业委员会副主任、《Int. J. Biomath.》期刊编委。曾赴丹麦科技大学留学一年，在韩国浦项科技大学作博士后研究一年。多次应邀到丹麦科技大学、 新加坡国立大学、韩国浦项科技大学、高丽大学、澳大利亚 New England 大学、加拿大 York 大学、巴西 Brasilia 大学等作短期学术访问。从事应用数学方面的研究，已出版专著一部，发表论文 100 余篇。主持国家自然科学基金面上项目 6 项、国际交流项目 2 项，2021 年独立获得江苏省科学技术三等奖。

Analysis of a Stochastic Within-Host Model of Dengue Infection with Immune

Response and Ornstein-Uhlenbeck Process

Qun Liu

Northeast Normal University, China

In this talk, by assuming the certain variable satisfies the Ornstein-Uhlenbeck process, we formulate a stochastic within-host dengue model with immune response to obtain further understanding of the transmission dynamics of dengue fever. Then we analyze the dynamical properties of the stochastic system in detail, including the existence and uniqueness of the global solution, the existence of a stationary distribution, the extinction of infected monocytes and free viruses. In particular, it is worth revealing that we get the specific form of covariance matrix in its probability density around the quasi-endemic equilibrium of the stochastic system. Finally, numerical illustrative examples are depicted to confirm our theoretical findings.

Biography: 刘群，东北师范大学副教授，博士生导师，主要从事随机微分方程及其应用方面的研究。主持国家自然科学基金青年项目、吉林省科技厅自由探索重点项目和吉林省教育厅重大项目各 1 项，在 JNS, DCDS, JMP, Chaos, JTB 等国际著名 SCI 期刊上发表多篇论文，其中 5 篇论文入选 ESI 高被引论文。

Effectiveness evaluation of mosquito suppression strategies on dengue transmission under changing temperature and precipitation

Kaihui Liu

Jiangsu University, China

Widespread resurgence of dengue outbreaks has seriously threatened the global health. Due to lack of treatments and vaccines, one key strategy in dengue control is to reduce the vector population size. As an environmentfriendly mosquito control approach, eleasing male mosquitoes transinfected with specific Wolbachia strain into the field to suppress the wild mosquito population size has become wildly accepted. The current study evaluates the effectiveness of this suppression strategy on dengue control under changing temperature and precipitation profiles. We formulate a mathematical model which includes larval intra-specific competition, the maturation period for mosquitoes, the extrinsic incubation period (EIP) and intrinsic incubation period (IIP). The persistence of mosquitoes and disease is discussed in terms of two basic reproduction numbers (RM and R0) and the release ratio pw. Further numerical simulations are carried out to not only validate theoretical results, but also provide interesting quantitative observations. Sensitivity analysis on the reproduction numbers, peak size, peak time and the final epidemic size is performed with respect to model parameters, which highlights effective control measures against dengue transmission. Moreover, by assuming temperature and precipitation dependent mosquito-related parameters, the model can be used to project the effectiveness of releasing Wolbachia carrying males under climatic variations. It is shown that the effectiveness of various control strategies is highly dependent on the changing temperature and precipitation profiles. In particular, the model projects that it is most challenging to control the disease at the favorable temperature (around 27-30) and precipitation (5-8mm/day) range, during which the basic reproduction number R0 is very high and more Wolbachiainfected males should be released.

Biography: 刘凯慧，2018 年 10 月毕业于香港理工大学获博士学位。2019 年 1 月入职江苏大学，2019 年 5 月至今任江苏大学副教授。主要研究方向为生物数学，包括种群动力学以及传染病的建模及分析。多篇论文发表在 Journal of Differential Equations, Nonlinear Analysis- Real Word Application，Journal of Mathematical Biology, Bulletin of Mathematical Biology, Journal of Theoretical Biology 等主流应用数学以及生物数学期刊。对具有季节驱动或年龄结构的种群动力系统和疾病传播动力学感兴趣。研究受国家自然科学基金和江苏省双创博士项目资助。

A Diffuse Interface Model of Fluid-Structure Interactions for Blood Flows and Thrombus

Yadong Liu

Nanjing Normal University, China

This talk concerns a diffuse interface model for the flow of two incompressible viscoelastic fluids in a bounded domain. More specifically, the fluids are assumed to be macroscopically immiscible, but with a small transition region, where the two components are partially mixed. Considering the elasticity of both components, one ends up with a coupled Oldroyd-B/Cahn-Hilliard type system, which describes the behavior of two-phase viscoelastic fluids. In particular, the model describes the interaction between thrombus and blood flows in human arteries. I will present some techniques we employed to prove the existence of weak solutions, which account for the poor compactness of the left Cauchy-Green tensor. Moreover, I will show recent progress on the global strong well-posedness in two dimensions. This talk is based on joint work with Dennis Trautwein (Regensburg).

Biography: 刘亚东，南京师范大学数学科学学院讲师。2023年7月博士毕业于德国雷根斯堡大学(Universität Regensburg)，同年8月至12月于雷根斯堡大学从事博士后工作。主要从事非线性偏微分方程，特别是流体自由边界相关的连续介质力学模型的适定性和奇异极限研究，如流固耦合问题、两相流问题、动态接触角问题等。研究成果发表在 Joumal of Differential Equations、Nonlinearity 等国际知名期刊上。

The dynamical analysis of a nonlocal predator–prey model with cannibalism

Daifeng Duan

Nanjing University of Posts and Telecommunications, China

Cannibalism is often an extreme interaction in the animal species to quell competition for limited resources. To model this critical factor, we improve the predator–prey model with nonlocal competition effect by incorporating the cannibalism term, and different kernels for competition are considered in this model numerically. We give the critical conditions leading to the double Hopf bifurcation, in which the gestation time delay and the diffusion coefficient were selected as the bifurcation parameters. The innovation of the work lies near the double Hopf bifurcation point, and the stable homogeneous and inhomogeneous periodic solutions can coexist. The theoretical

results of the extended centre manifold reduction and normal form method are in good agreement with the numerical simulation.

Biography: 段代凤，南京邮电大学讲师，校长专聘副教授。目前主要从事时滞反应扩散方程的分支理论研究，近 5 年在《European J. Appl. Math.》、《Chaos, Solitons, Fractals》、《Int. J. Bifurcation and Chaos》、《Discr. Contin. Dyn. Syst. Ser. B》等期刊发表论文 10 篇，第一作者论文 8 篇。主持山东省自然科学基金项目一项。

Delay induced rich dynamics of tumor-immune system models

Yueping Dong

Central China Normal University, China

The immune system needs time to develop a suitable response after the invasion of tumor cells. The immune activation delay can affect the dynamics of the model leading to very rich dynamics, such as Hopf bifurcation, BT bifurcation and so on. Besides, the dual role of delay effects was observed in several tumor-immune system models, which shows destabilization as well as stabilization of the tumor-presence equilibrium. The results revealed that an appropriate immune activation delay plays an important role in control of tumor growth.

Biography: 董岳平，华中师范大学副教授，博士毕业于日本静冈大学。主要从事生物数学、微分方程和动力系统理论及其在生命科学与医学中的应用等领域的研究。近年来主持国家自然科学基金项目 2 项、湖北省自然科学基金项目 1 项。在 SIAM J. Appl. Math.、Am. Nat.、J. Theor. Biol.、BMJ Open、Nonlinear Dyn.、Appl. Math. Lett.、Appl. Math. Model.、Appl. Math. Comput.、Int. J. Bifurcat. Chaos、Discrete Contin. Dyn. Syst. B 等期刊上发表学术论文 30 余篇。

Modeling HIV persistence and viral rebound

Ting Guo

Changzhou University, China

Despite years of combined antiretroviral therapy (cART), HIV persists in infected individuals. The virus also rebounds after the cessation of cART. The sources contributing to viral persistence and rebound are not fully understood. When viral rebound occurs, what affects the time to rebound and how to delay the rebound remain unclear. In this paper, we started with the data fitting of an HIV infection model to the viral load data in treated and untreated humanized myeloid-only mice (MoM) in which macrophages serve as the target of HIV infection. By fixing the parameter values for macrophages from the MoM fitting, we fit a mathematical model including the infection of two target cell populations to the viral load data from humanized bone marrow/liver/thymus (BLT) mice, in which both CD4+ T cells and macrophages are the target of HIV infection. Data fitting suggests that the viral load decay in BLT mice under treatment has three phases. The loss of infected CD4+ T cells and macrophages is a major contributor to the first two phases of viral decay, and the last phase may be due to the latent infection of CD4+ T cells. Numerical simulations using parameter estimates from the data fitting show that the pre-

ART viral load and the latent reservoir size at treatment cessation can affect viral growth rate and predict the time to viral rebound. Model simulations further reveal that early and prolonged cART can delay the viral rebound after cessation of treatment, which may have implications in the search for functional control of HIV infection.

Biography: 郭婷，南京理工大学数学博士，2021 年 10 月就职于常州大学。主要从事微分方程与动力系统、数学建模等方面的研究及应用，在 J. Math. Biol., J. Theor. Biol.,等国际期刊发表学术论文 10 余篇，主持国家自然科学基金 1 项、江苏省和常州市基金 3 项。

Turing-Hopf Interaction on a Circular Domain

Ben Niu

Harbin Institute of Technology (WH), China

Turing instability and Hopf bifurcation are two important kinds of transitions giving birth to inhomogeneous solutions, in spatial or temporal ways. On a disk, these two bifurcations may lead to equivariant Turing-Hopf bifurcations whose normal forms are discussed in several different cases. We analyzed the possible solutions for each case, and tried to find solutions with physical significance in real-world systems.

Biography: 牛犇，哈尔滨工业大学（威海）数学系副教授，博导，研究方向主要为泛函微分方程的分支理论及其应用，包括中立型泛函微分方程的高余维分支、具时滞反应扩散方程的分支研究和对称区域上反应扩散方程的分支问题研究等。

Single Species Population Models with Harvesting and Gompertz Tumor Model with Periodical Treatment

Shigui Ruan

University of Miami, USA

It is important to include economic factors in population dynamical models and it is necessary to develop an ecologically acceptable strategy for harvesting any renewable resource such as animals, fish, plants, etc. Mathematically, it is crucial to study various the dynamics in a biological system when it is perturbed by the harvesting effort. There are several types of harvesting, including constant-effort (linear), constant-yield, nonlinear, and periodic harvesting. Recently, the open/closed fishing strategy is modeled by using a piecewise switch function. In this talk, we will review different dynamical results and biological outcomes when a single species is harvested by all these types of harvesting. Finally, Gompertz tumor model with periodic treatment will be introduced and results will be applied to fit the data on prostate cancer with treatments.

Biography: 阮士贵，国家高层次人才获得者。1983 年本科毕业于华中师范大学数学系，1988 年获得华中师范大学数学系硕士学位，1992 年获得加拿大阿尔伯塔大学数学系博士学位，1992-1994 年在加拿大菲尔兹数学所和麦克马斯特大学做博士后。1994-2002 年在加拿大道尔豪斯大学数学与统计系先后任助理教授和副教授，现为美国迈阿密大学数学系终身教授。主要研究领域是动力系统和微分方程及其在生物和医学中的应用。在包括《PNAS》、《Lancet Infect Dis》、《Memoirs Amer Math Soc》、《Trans Amer Math Soc》、

《J Funct Anal》、《J Math Pures Appl》、《Math Ann》等学术期刊上发表了 200 多篇学术论文，受到了国内外同行的关注与大量引用，2014 和 2015 年连续被汤森路透集团列为全球高被引科学家。担任了一些重要学术期刊如《BMC Infectious Diseases》、《Bulletin of Mathematical Biology》（高级编委）、《Journal of Mathematical Biology》、《Mathematical Biosciences》等的编委，是《Mathematical Biosciences and Engineering》的主编（数学）。作为项目负责人多次获得美国国家卫生研究院（NIH）、美国国家科学基金（NSF）、国家自然科学基金会资助。

Is there a risk of Chikungunya autochthonous transmission and outbreak in Ontario, Canada?

Haitao Song

Shanxi University, China

Chikungunya is a mosquito-borne disease that is transmitted by Aedes mosquitoes. In 2013, Chikungunya spread across Central and South America as well as the Caribbean. As the climatechanges, a northward migration seems likely. As the major vector transmitting mosquito-borne diseases such as Chikungunya and dengue, adult Aedes aegypti and Aedes albopictus mosquitoes were captured in Windsor of southern Ontario, Canada since the summer of 2016, which suggests that the aedes mosquito species may become established in Canada as the climate warms. To assess the risk of Chikungunya endemic in Canada, we developed a mathematical model that incorporates maturation delay for mosquito reproduction as well as extrinsic and intrinsic incubation delays due to the impact of temperature conditions. The basic reproduction number was computed to evaluate the effect of temperature on the risk of Chikungunya virus transmission in Canada. The dynamical analysis shows that maturation delay may destabilize the infected steady state through a Hopf bifurcation. However, extrinsic incubation delay and intrinsic incubation delay do not affect the stability of the infected steady state but rather alter the peaking time and number of infected humans. The temperature-derived risk classes for Chikungunya virus transmission in Canada were created based on the effect of temperature on the maturation period and extrinsic incubation period. Using our model and basic reproduction number, we generated risk maps of Chikungunya spread concerning the increase in temperature showing that the risk of the virus may be more acute in the areas further north and west of Ontario and Canada.

Biography: 宋海涛，山西大学复杂系统研究所，教授，博士生导师，加拿大约克大学博士后，美国数学会《数学评论》评论员，中国数学会生物数学专业委员会青年工作委员会委员。主要研究领域为生物数学、微分方程和动力系统。本硕博就读于哈尔滨工业大学，于2015年获得数学博士学位，并于2016-2018年在加拿大约克大学做博士后研究（合作导师是朱怀平教授）。在微分方程相关领域发表学术论文20余篇，主持或完成2项国家自然科学基金（面上项目和青年项目）和6项省部级项目，参与国家自然科学基金重点项目1项。以第一完成人获得2023年山西省科学技术奖（自然科学奖）二等奖，获得山西省高等学校优秀青年学术带头人、三晋英才-青年优秀人才、山西大学青年五四奖章。

Universal model, generalization and application of drug toxicological effects (药物毒理效应的普适性模型、推广及应用)

Sanyi Tang

Shanxi University, China

不同外来化合物在不同具体条件下，所引起的效应或反应类型不同，而呈现不同类型的剂量---效应曲线，其中包括单调、U-型、倒U-型和钟型等。为了刻画上述不同类型的剂量---效应曲线，研究者分别提出了众多的复杂模型来拟合不同的量效关系，缺乏一般性，这使得应用相关模型具有较大挑战。为了克服上述困难，我们提出具有普适性的药物毒理效应Ricker模型，理论上得到了模型存在药物毒理效应的复杂参数空间。进一步考虑滞后效应、随机扰动等因素，发展模型、拓展模型的应用领域。同时，利用所发展的模型对害虫控制、中药制剂、肿瘤免疫治疗中托众多类型的剂量---效应曲线进行拟合，发现所提出的模型能够对发生药物毒理效应的剂量---效应曲线进行更好的拟合，具有普适性。最后也将介绍更为一般和广泛的应用模型研究、困难与挑战。

Biography: 唐三一，主要从事生物数学和生物统计学研究，发展和创建了一套分析脉冲半动力系统的定性理论方法，推广了Filippov系统理论在生物医学阈值策略中的广泛应用，解决了非线性、非光滑米氏药动学方程解析求解的理论难题。主要成果在害虫综合治理策略、突发性传染病预测预警、药动学参数确定、肿瘤综合治疗与药物毒理效应等方面具有重要的应用。发表SCI论文130多篇，被SCI期刊引用超过9500次。主持1项国家自然科学基金重点项目，参与1项国家自然科学基金重点项目，主持中美生物医学国际合作项目1项，其它不同学部国家自然科学基金面上项目5项。2018年获陕西省科技创新领军人才称号。近年来带领团队与国家疾控、卫健委等部门合作，为基于地域的HIV治疗策略，以及新冠疫情防控的重大策略调整提供了重要的决策依据，服务了国家重大急需。

Exploring Spatiotemporal Patterns of Algal Cell Density in Lake Dianchi with Explainable Machine Learning

Yiwen Tao

Zhengzhou University, China

The escalating global occurrence of algal blooms poses a growing threat to ecosystem services. In this study, the spatiotemporal heterogeneity of water quality parameters was leveraged to partition Lake Dianchi into three clusters. Considering water quality parameters and both the delayed and instantaneous effects of meteorological factors, ensemble learning, and quasi-Monte Carlo methods were employed to predict daily algal cell density (AD) between January 2021 and January 2024. Consistently, superior predictive accuracy across all three clusters was exhibited by the Stacking-Elastic-Net regularization model. Furthermore, the minimum combination of drivers that achieved near-optimal accuracy for each cluster was identified, striking a balance between accuracy and cost. The ranking of the effect of drivers on AD varied by cluster, while the delayed effect of meteorological factors on AD generally outweighed their instantaneous effect for all clusters. Additionally, the heterogeneous or homogeneous thresholds and responses

between drivers and AD were explored. These findings could provide a scientific and economically efficient foundation for governmental agencies to formulate regional sustainable strategies for water quality management.

Biography: 陶亦文，郑州大学副研究员；主持国家自然科学基金一项，省部级人才项目两项；在 Total science of environment，Journal of environmental management，IEEE transaction on geoscience and remote sensing，Journal of nonlinear science，SIAM journal on applied mathematics等重要期刊上发表文章。

基于分子生物学机制和临床数据的慢性HBV感染动力学模型

Kaifa Wang

Southwest University, China

乙型肝炎病毒（HBV）感染一直是一个主要的全球公共卫生问题。慢性乙型肝炎（CHB）是由HBV持续感染6个月以上引起的，其治疗主要是延缓疾病进展，降低肝硬化（LC）和肝细胞癌（HCC）的发病率，提高患者的生存率。根据HBV感染后病毒复制和宿主免疫反应的生物学机制，包括共价闭合环状DNA与树突状细胞的作用，以及CTLs增殖存在的区间时滞，几个动力学模型被提出来用于模拟宿主体内HBV感染的进程。结合临床患者数据，探究分析了宿主体内HBV、肝细胞和患者免疫系统相互作用的复杂动态过程。

Biography: 王开发，西南大学教授、博士生导师。主要从事生物数学、生物统计与计算医学方面的研究，包括病毒感染动力学机理、临床数据分析和传染病建模。主持国家自然科学基金5项（在研1项）、重庆市自然科学基金2项；在国内外期刊上发表论文80余篇，其中Faculty of 1000医学推荐收录1篇；2003年获军队科技进步三等奖1项（1/4）、2019年获重庆市科技进步一等奖1项（8/10）；获批国家发明专利2项（第二完成人）。

Threshold dynamics of a mosquito-borne disease model with chemotaxis and spatial heterogeneity

Kai Wang

Guangzhou University, China

In this talk, I will introduce a spatial chemotactic mosquito-borne disease model. We first proved the global existence and boundedness of solutions to guarantee the solvability of the model. Next, the threshold dynamics were obtained. Furthermore, we numerically explored the impacts of chemotactic effect, spatial heterogeneity and dispersal rates of infected individuals to provide a clear picture on disease severity. In particular, we find that the mosquito chemotaxis causes mild disease in some regions but severe in others, which suggests developing targeted strategies to control mosquitoes in specific locations and achieve a deep understanding on the chemotaxis.

Biography: 王凯，广州大学应用数学研究中心博士后，合作导师为庾建设教授。研究方向为:传染病动力学建模与分析。在SIAP，JDE，JDDE等期刊上发表论文近20篇。目前主持博士后基金面上项目和国家资助博士后研究人员计划项目。

Hopf bifurcation in a reaction-diffusion-advection model with nonlocal delay effect and Dirichlet boundary condition

Xiaoli Wang

Southwest University, China

In this paper, we investigate a reaction-diffusion-advection model with nonlocal delay effect and homogeneous Dirichlet boundary conditions. We establish the existence of a nonconstant positive steady state and the associated Hopf bifurcation by using the Lyapunov-Schmit reduction. We also give some applications of the theoretical results to models with a logistic growth rate and a weak Allee growth rate.

Biography: 王小利，西南大学数学与统计学院教授，硕士研究生导师, 美国数学学会评论员，重庆市工业与应用数学学会(SIAM)理事，美国威廉玛丽学院（College of William and Mary)访问学者。研究方向主要为生物数学及动力系统，其研究成果主要发表在BMB，JTB, MB, CNSNS,MMAS等国内外重要生物数学学术期刊上。

Truncated E-M Method for Stochastic L-V Competition Models

Fengying Wei

Fuzhou University, China

In this talk, we aimed at the well-known stochastic Lotka–Volterra model with the interaction of multi-species in ecology of having some typical features: highly nonlinear, positive solution and multi-dimensional. The known numerical methods including the tamed/truncated Euler–Maruyama (EM) applied to it do not preserve the positivity of the stochastic L-V compitition models. The aim of this talk is to modify the truncated EM to establish a new positive preserving truncated EM (PPTEM). To simplify the proof as well as to make our theory more understandable, we first develop a nonnegative preserving truncated EM (NPTEM) and then establish the PPTEM. Of course, we should point out that the NPTEM has its own right as many SDE models in applications have their nonnegative solutions.

Biography: 魏凤英，福州大学数学与统计学院教授，现任数学与应用数学系党支部书记、福建省第四届生物数学学会秘书长、福建省女科协第三届理事会理事。主要科研兴趣包括随机微分方程及其在数学流行病学及生物种群方面的应用。曾参加范更华教授主持的离散数学及其应用“211工程”重点学科团队；曾主持国家级项目三项，主持福建省科技厅项目五项；曾参与国家及教育部项目四项；参编高等教育出版社的教材两部；累计发表高水平论文百余篇；指导一人次获福建省优秀硕士学位论文，五人次获福州大学优秀硕士学位论文。曾先后多次学术访问美国、英国、芬兰等境外知名高校。

Dynamics of reaction-diffusion mussel-algae system

Junjie Wei

Fuzhou University, China

In this talk, we will consider the dynamics of two mussel-algal reaction-diffusion models with different mussel mortality. For the first model, we are concerned with the Hopf bifurcation

and Turing-Hopf bifurcation. For the second model, we mainly focus on the existence of nonconstant steady states.

Biography: 魏俊杰，博士，二级教授，博士生导师，哈尔滨工业大学（威海）理学院院长，主要从事泛函微分方程分支理论及应用的研究工作，在J. Differential Equations, Nonlinearity, J. Dynam. Differential Equations 和Discrete Contin. Dyn. Syst. A等期刊发表SCI论文180余篇，先后获得黑龙江省科学技术（自然类）二等奖和教育部高等学校科学研究优秀成果（自然科学）二等奖各一项；指导毕业的博士中有两人获得全国百篇优秀博士论文提名奖。

PrEP Intervention in the Mitigation of HIV/AIDS Epidemics in China via a Data-Validated Age-Structured Model

Peng Wu

Hangzhou Dianzi University, China

Antiretroviral-based pre-exposure prophylaxis (PrEP) treatment offers a new opportunity for protecting humans against HIV and disrupting current HIV prevention systems. However, implementing this preventive measure has been difficult due to its high cost. In this paper, we propose an age-structured model that incorporates infection ages, HAART (highly active antiretroviral therapy), and PrEP intervention. We investigate the qualitative behavior of the model and find a threshold parameter (the basic reproduction number) that determines the asymptotic stability of equilibria. We validate the model and estimate the parameters by confronting the actual HIV/AIDS data from 2004 to 2018 in China using MCMC (Markov Chain Monte Carlo) method. Furthermore, we investigate the PrEP intervention strategy by using incremental cost-effectiveness and average cost-effectiveness. Our work suggests that PrEP intervention based on the infection characteristics of different age groups can be an effective strategy to eradicate HIV/AIDS epidemics in China.

Biography: 吴鹏，理学博士，杭州电子科技大学特聘副教授。主要从事HIV/AIDS动力学建模与理论分析。主持国家自然科学基金青年基金一项，浙江省教育厅项目一项。在Journal of Mathemtical Biology、 Bulletin of Mathematical Biology、Journal of Computational and Applied Mathematics、 Nonlinear Analysis: Real World Applications、Discrete and Continuous Dynamical Systems Series B、Communications in Nonlinear Science and Numerical Simulation、Applied Mathematics Modelling等应用数学领域期刊发表学术论文30余篇。

Pattern Formation in Mathematical Biology

Yuan Yuan

Memorial University of Newfoundland, Canada

It's fascinating how models of biological pattern formation combine concepts of space, time, and interaction. The examples of pattern formation in biology are incredibly diverse and can be found in a wide variety of tissues and organisms. It makes us wonder what mathematical structures are appropriate for the analysis of such systems. From dynamical point of view, we try to provide

some methods to analytically understand the existence of pattern solutions in nonlinear dynamical systems and apply the theoretical results in some real applications.

Biography: 袁沅，加拿大纽芬兰纪念大学（Memorial University of Newfoundland）终身正教授、博士生导师。主要研究方向包括非线性动力系统的稳定性及分支分析、时滞微分方程及其在神经网络和生物数学等的应用、微分方程的符号及数值计算方法。现已在SIAM Journal of Applied Mathematics, Journal of Mathematical Biology, Journal of Mathematical Analysis and Applications, Journal of Differential Equations, Nonlinear Analysis: Real World Applications, SIAM Journal on Applied Dynamical Systems等主要应用数学及生物数学期刊发表论文六十多篇，研究一直受到加拿大NSERC的资助。

Dynamic analysis and parameter identification of network spatiotemporal evolution model

Linhe Zhu

Jiangsu University

Spatial heterogeneity and population migration may affect transmission threshold and the asymptotic behavior of information transmission near the steady state. To investigate this issue, an epidemic-like information transmission model with nonlinear natural growth mechanism and linear migration mechanism based on multi-patch structure is established. First, we study the findings related to the equilibrium state of the system and the transmission threshold, proving the uniqueness and the existence of information -free equilibrium points, the existence of positive equilibrium points under certain conditions and the non-existence of mixed equilibrium points. Meanwhile, we discuss the asymptotic behavior of various types of information points and define the global basic reproduction number and the local basic reproduction number, demonstrating some of their unequal relationships. Further, we also consider the impact of the blockade mechanism on the patch model, illustrating that the information disappears or persists in single patch under certain conditions. Finally, we carry out the numerical simulation analysis of our system. The results suggest that the information may form a certain oscillatory pattern in space and there are multiple positive equilibrium points for the system. At the same time, the blockade mechanism may lead to different types of equilibrium states in different patches, but it is not effective in reducing the total number of infected individuals and the convergence time of the system.

Biography: 朱霖河，江苏大学副教授，硕士生导师，主要从事复杂网络动力学与控制的研究工作，以第一或通讯作者在Engineering Applications of Artificial Intelligence、Information Processing and Management、Information Sciences、Journal of Nonlinear Science等期刊发表SCI论文50余篇，主持国家级、省部级科研项目6项，2021年入选江苏省青年科技人才托举工程，2016年获江苏省高校自然科学奖二等奖。近三年，指导学生获得“挑战杯”大学生课外学术科技作品竞赛全国二等奖、江苏省特等奖，数学建模全国一等奖、二等奖20余项。

演化区域中的种群模型动力学

Min Zhu

Anhui Normal University, China

蚊媒传染病所在的空间环境和栖息地不是一成不变的，而是会随着季节变化呈周期性变化，也变因全球气候变暖而呈现扩大趋势，这一现象意味着我们在利用反应-扩散方程构建一些传染病模型时要考虑到区域的变化。本报告分别从区域的周期性演化、有限增长变化、无限增长变化等不同情形下阐述登革热模型在变化区域条件中的传播动力学，并将该蚊媒传染病模型推广至一般的种群模型，给出统一的动力学结果。

Biography: 朱敏，安徽师范大学数学与统计学院教授，硕士生导师，现为应用数学系系主任，主要从事生物数学方向的研究。主持国家自然科学基金1项，省自然科学项目面上项目1项，厅级科研项目2项以及省级重大、重点、一般教研项目各1项。先后获安徽省科学技术奖三等奖（排名3/3）以及安徽省第七届优秀学术论文三等奖（独立），在国内外核心期刊发表学术论文三十余篇，其中SCI论文近二十篇。

具有恐惧效应及斑块结构的捕食者-食饵模型动力学

Tianran Zhang

Southwest University, China

在食饵-捕食者相互作用过程中，由于对被捕食风险的恐惧，食饵种群可能会以减少资源为代价，降低出生率或逃离捕食者高水平区域。本文构建了一个具有恐惧效应和斑块结构的捕食者-食饵模型，其中恐惧会降低食饵出生率，会促使食饵逃到无捕食者斑块（以降低资源获取为代价）。研究了恐惧和扩散对捕食者-食饵模型动力学的影响，得到了平衡点的稳定性和Hopf分岔的存在性。数值模拟表明，如果不考虑恐惧导致的扩散行为，则震荡现象存在被低估或高估的可行性。

Biography: 张天然，理学博士，西南大学教授，美国《数学评论》评论员。研究领域为微分方程及生物数学，主要使用反应扩散系统刻画种群扩散及传染病的传播规律，在非合作反应扩散系统行波解的存在性方面取得了一些进展，部分成果发表在在SIAM J. Math. Anal.，J. Differential Equations等期刊上。主持国家自然科学基金面上项目2项、重庆市自然科学基金2项。

Modeling the spread of Wolbachia in wild mosquitoes with birth-pulse and insecticide impulsive spraying

Xianghong Zhang

Southwest University, China

Wolbachia as an innovative technique has been approved to inhibit the replication of dengue viruses in mosquitoes. We firstly build a birth-pulse model with sex structures to depict the nonlinear dynamics of mosquito population and then to investigate how Wolbachia can suppress or replace wild mosquitoes. The existence and stability of periodic solutions of the system are

proved by analyzing its stroboscopic map. Under incomplete maternal transmission, there may be two pairs of bistable periodic solutions. Next, an impulsive differential model with four state variables are proposed to describe the spread of Wolbachia in mosquito population with considering the spray of chemical insecticide. The stability and permanence of periodic solutions, and the existence of backward or forward bifurcation are obtained by using the stability and bifurcation analysis theory. The results indicate that the integrated use of Wolbachia and pulse spaying insecticide can not only significantly reduce the quantity of mosquitoes, but also help to achieving the strategy of mosquito eradication or increasing parameter regions for the success of the strategy of mosquito replacement.

Biography: 张香红，西南大学数学与统计学院副教授，重庆市海外引进高层次人才第四类。2017年7月博士毕业于陕西师范大学。博士期间和博士毕业后，分别到加拿大约克大学博士联合培养一年和从事博士后研究两年。主要从事微分方程动力系统及分支理论，非光滑动力系统的理论和数值分析，以及其在传染病和害虫防控等方面的应用。2019年获陕西省优秀博士学位论文、主持国家自然科学基金青年项目、重庆市自然科学基金面上项目，重庆市留学创新项目各1项，先后在J. Math. Biol., J. Dyn. Differ. Equ., Bull. Math. Biol., Math. Biosci., J. Theor. Biol.等期刊上发表论文近20篇。

Dynamics analysis of non-smooth diffusive population model

Xuebing Zhang

Nanjing University of Information Science and Technology, China

We have established several classes of reaction-diffusion population models with non-smooth terms, and our study is divided into two major parts. First, for models with continuous non-smooth terms, we investigate the well-posedness of the model solutions, the existence and stability of equilibrium points, the discontinuous Hopf bifurcation problem, and the existence of non-constant steady-state solutions. Second, for models with discontinuous terms at the right boundary, we analyze the existence and stability of true and spurious equilibrium points, non-smooth bifurcation phenomena, and the unique sliding modes characteristic of discontinuous systems. Additionally, we employ semigroup theory, smoothing techniques, and the Galerkin method to explore the existence of solutions. Using the Leray-Schauder degree theory, we investigate the existence of constant steady-state solutions. Furthermore, we utilize the Lyapunov function method to discuss the global asymptotic stability and finite-time convergence of non-constant steady-state solutions, as well as the steady-state bifurcation problem.

Biography: 张学兵，南京信息工程大学数学与统计学院副教授。博士毕业于南京航空航天大学数学系。研究方向为生物动力系统建模及其动力学分析。在J. Theor. Biol.、Math. Biosci.，Z. Angew. Math. Phys.、J. Math. Anal. Appl.、Nonlinear Dyn.等期刊上发表论文30余篇，先后参与国家自然科学基金项目3项，主持完成江苏省自然科学基金项目1项。江苏省“333高层次人才培养工程”第三层次培养对象，曾获得江苏省教育科学研究成果奖（高校科学研究技术类）二等奖。

Dynamics of lung cancer model and influence factors of lung cancer

Jingnan Wang

Harbin University of Science and Technology, China

Using statistical analysis，we obtain some important influencing factors of lung cancer . Considering the existence of time delays in lung cancer growth, we establish a smoking and lung cancer growth interaction model with double time delays . By analyzing the distribution of characteristic equation roots and the stability switching curves, as well as the conditions of equilibrium asymptotic stability and Hopf bifurcation, the specific effects of smoking on the growth of lung cancer are studied. On the basis of the stability and direction calculation formulas of the Hopf bifurcating periodic solutions, numerical simulations are used to show the change laws of lung cancer growth, such as steady state, periodic oscillations and chaos, when the parameters of environmental carrying capacity, passive smoking rate and time delays are changed.

Biography: 王晶囡，哈尔滨理工大学应用数学系教授，研究方向：动力系统定性理论及其应用，生物数学

基于气象因素的蚊媒生态参数表达式及对蚊媒传染病的影响

Guanghu Zhu

Guilin University Of Electronic Technology, China

利用人工模拟实验室设置了27种不同的气象条件下观测记录成蚊的孵化时间、羽化时间、成虫寿命、产卵量的变化过程；利用广义加性模型和多项式回归分析白纹伊蚊的生物学参数表达式。接着结合温度影响建立动力学模型模拟寨卡病毒传播过程，根据巴西和新加坡疫情拟合参数并校正模型，求解出带温度效应的基本再生数和蚊媒基本再生数，利用模型模拟估计东南亚各国逐月的感染风险和可能的传播模式，发现蚊媒种群和寨卡发病率对蚊媒生态参数最为敏感，多路径传播且高温加剧了寨卡病毒感染风险。

Biography: 祝光湖, 博士生导师，先后在香港城市大学和香港浸会大学担任研究助理和博士后工作，是中山大学公共卫生学院和广东省疾控中心联合培养的博士后；是广西高校中青年骨干教师、中国生物数学会委员、美国数学评论员、广西生物数学学会副理事长、期刊BMC Public Health、BMC Infectious Diseases和华南预防医学的编委，主持国家及省部级项目5项，发表SCI论文40余篇。研究方向为传染病动力学、卫生统计学，主要探索传染病的时空传播机理，疫情防控策略和风险评估，以及各类慢病的机理模型和影响因素分析。

Dynamics of a time-switched model with Ricker-type survival probability

Zhongcai Zhu

Guangzhou University, China

Mosquito-borne diseases such as dengue fever and malaria have been seriously endangering human life, health and safety. Sterile insect technique is a suitable prevention and control method. Among which, the density-dependent survival probability of wild mosquitoes in the aquatic stage will affect their final suppression effect. Here, we establish a model with a Ricker exponential-type density-dependent survival probability function and time switching. To determine the exact

number of periodic solutions and their corresponding asymptotic stability of the model, we first define a Poincaré map. Next, by analyzing the qualitative properties of the Poincaré map and the right-hand functions of the two equations that make up the switching model, we find two release amount thresholds and one release period threshold. Based on these three thresholds, combining with the mathematical theories and ideas such as variable separation method, inverse proof method, Poincaré mapping method and perturbation technique, we get two theorems to describe the exact number of periodic solutions and their corresponding asymptotic stability. In addition, numerical examples are given to support and illustrate the theoretical results obtained. The results of our study can provide a theoretical reference for the staff working in the line of releasing sterile mosquitoes, and help them to formulate more efficient and economical release strategies.

Biography: 朱忠才，广州大学数学与信息科学学院暨广州大学应用数学研究中心博士后，合作导师为郑波教授。主要研究方向为蚊媒传染病防控的理论建模分析与数值仿真模拟，在Nonlinear Dynamics、Journal of Biological Dynamics、Journal of Applied Analysis and Computation、Mathematical Biosciences and Engineering等期刊发表学术论文多篇，目前主持中国博士后科学基金第74批面上资助项目。

Abstract-Graduate Students Forum

(Alphabetic order)

Atherosclerosis models based on fluid-structure interaction and reaction-diffusion

Yanning An

Nanjing University of Information Science and Technology, China

In this paper, we establish a model of atherosclerosis in the early stage based on fluid-structure interaction (FSI) model of blood vessel and reaction-diffusion equations. The model consists of Navier-Stokes equation, Biot equations, and reaction-diffusion equations, which involves the effect of blood flow velocity on the concentration of low density lipoprotein (LDL) and other biological components. By using Rothe's method and operator splitting numerical scheme, we prove the existence of weak solutions. Furthermore, numerical simulations were performed in an idealized two-dimensional geometry in order to verify our assumptions in model building and theoretical analysis.

Optimal harvest control of predator-prey systems in fisheries with stage structure and additional food supply

Xingyu Bo

Nanjing University of Information Science and Technology, China

In this paper, we consider a fishery predator-prey system with stage structure and additional food incorporating fluctuations in resource prices influenced by supply and demand. The fishery system can be regarded as a slow-fast system under some suitable assumptions. Through variable aggregation methods, we derive a simplified four-dimensional model governing the density of prey fish, the juvenile and adult predator densities, and fishing effort in the fishery. We perform a stability analysis of the simplified system and give the optimal harvesting policy by using Pontryagin's maximum principle. In our analysis, we find that the catastrophe equilibrium point corresponding to overfishing leading to fish extinction is unstable, which indicates that the predator stage structure has an impact on the stability of the system. Moreover, we find that due to the additional food item the system appears to have prey-free equilibrium points, which indicates that the system does not collapse due to the extinction of one prey item. We also give thresholds for the amount of additional food needed to maintain the balance of the system under different circumstances.

Stability analysis of an atherosclerotic plaque formation model with time delay

Yonglin Chen

Nanjing University of Information Science and Technology, China

Atherosclerosis is a chronic inflammatory disease that poses a serious threat to human health. It starts with the buildup of plaque in the artery wall, which results from the accumulation of pro-inflammatory factors and other substances. In this paper, we propose a mathematical model of early atherosclerosis with a free boundary and time delay. The time delay represents the transformation of macrophages into foam cells. We obtain an explicit solution and analyze the stability of the model and the effect of the time delay on plaque size. We show that for non-radial symmetric perturbations, when or , the steady-state solution is linearly stable; when , there exists a critical parameter such that the steady-state solution is linearly stable for and unstable for . Moreover, we find that smaller plaque are associated with the presence of time delay.

Optimal harvest for predator–prey fishery models with variable price and marine protected area

Cheng Chu

Nanjing University of Information Science and Technology, China

In this paper, we propose a predator–prey fishery model with prey harvesting, variable price and marine protected area. We assume the price changes faster than other processes such as population growth and predation, and get a slow fast Ordinary Differential Equation (ODE) system. A simplified three-dimensional model is obtained by using approximate aggregation methods. The results show that there are two main scenarios, one is the depletion of fish stocks due to overfishing by fishermen, which is called a “catastrophic”equilibrium; and the other is a stable and sustainable fishery equilibrium. In order to avoid the extinction of fish, we consider establishing marine protected area (MPA) near fishing areas where fishermen only catch the prey. The results of the study provide the conditions for the establishment of MPA, allowing us to avoid the extinction of prey populations and establish sustainable fisheries. As another possibility, we consider increasing taxes to discourage overfishing by fishermen. In addition, when the tax revenue increases, the optimal harvest strategy is obtained. The optimal policy ensures the sustainable development of fisheries and maximizes the interests of fishermen.

Modeling the effects of awareness and information diffusion on green behavior spreading in multiplex networks

Yi Ding

Jiangsu University, China

随着人们对能源经济的关注不断增加，绿色行为与能源经济之间的联系越来越紧密。本文首先建立了一个三层网络NP-UAT-SIR模型，以研究信息扩散、意识和绿色行为传播之间的相互联系。随后，利用马尔科夫链分析了12种状态之间的状态转移概率树，并推导出各个状态之间的状态转移方程，从而计算出状态转变阈值p_2^C的表达式。接着，运用反应扩散系统描述了绿色行为传播层中每个状态的空间-时间变化关系，得到了平衡点P的表达式，并确定了发生Turing分岔的条件。最后，通过最优控制方法实现了参数识别，并

通过大量的数值模拟验证了本文中的理论。

Delayed Feedback Control for the Consensus and Average Quasi-Consensus of Delayed Second-order Multi-agent Systems

Qiang Fu

Nanjing University of Information Science and Technology, China

The delayed feedback control for the consensus and average quasi-consensus of delayed second-order multi-agent systems is studied. Firstly, we consider two weight matrices where the interactions are not entirely cooperative into the second-order multi-agent systems with mixed time-varying delays. Secondly, we design a delayed feedback control based on two weight matrices where the interactions are cooperative to get the consensus among the followers and the average quasi-consensus between the leader and the follower. We will study the consensus and average quasi-consensus of the delayed second-order multi-agent systems by graph-theoretic technique and Lyapunov functions. Finally, an example is given to illustrate the theoretical results.

Modeling mosquito control by an impulsive reaction–diffusion model on a periodically evolving domain

Yun Li

Nanjing University of Aeronautics and Astronautics, China

In this work，we construct and analyze a reaction–diffusion hybrid model incorporating impulsive control and periodic evolution domain in Wolbachia-infected and wild mosquito populations to investigate the joint impact of spatial diffusion, impulsive control and the evolution of a domain on the control of mosquitoes. The explicit formulas of the two ecological reproduction indexes are introduced, which relate to the diffusion, the evolution rate of domain and the impulsive function. Then we establish the threshold-type dynamics for the impulsive problem in terms of the two ecological reproduction indexes by the method of upper and lower solutions, which present the extinction of mosquitoes, and competition and the coexistence of Wolbachia-infected and wild mosquitoes under impulsive control and periodic evolution domain. Numerically, we perform simulations to certify the analytical results, determine the importance of parameters on the persistence and extinction of mosquito populations, and expound how impulsive control, the evolution domain and fitness effect caused by Wolbachia affect the mosquito population evolution.

Study on the complex dynamics of green behavior spreading on large-scale heterogeneous networks

Bingxin Li

Jiangsu University, China

Clear waters and lush mountains constitute invaluable assets, and the sustainable development of the energy economy relies on green behavior. This paper establishes a Centrist-

Positive-Negative system for the propagation of green behavior in heterogeneous networks, considering the transition mechanisms among individuals with different attitudes. The equilibrium points of the system are computed, and the necessary and sufficient conditions for the existence of positive equilibrium points are provided. We analyze the necessary conditions for Turing instability and the first-order conditions for parameter identification based on optimal control. Numerical simulation results indicate that the timing of Turing bifurcation can be influenced by various network structures. Moreover, the presence of heterogeneity within networks exacerbates the instability of solutions. Notably, both media publicity and government management exert an inverted U-shaped influence on outcomes. Furthermore, the homogeneity or heterogeneity of the network should not affect the effectiveness of parameter identification. Utilizing real data from the Policy Research Center for Environment and Economy and the China National Environmental Monitoring Centre, we conduct parameter identification on the effectiveness of government management in 13 cities in Jiangsu Province in 2021, yielding promising results. The study suggests that extending the network to a larger scale may further enhance identification performance.

Parameter identification of a reaction-diffusion predator-prey system based on optimal control theory

Li Miao

Jiangsu University, China

The research takes a reaction-diffusion predator-prey system with ratio-dependent Holling 3 functional response function and Leslie-Gower term into consideration. First of all, the system model is proposed on the basis of basic biological assumptions and previous work, and the existence conditions of the equilibrium point of the system are discussed. Secondly, under the assumption of the existence of equilibrium point, the Turing instability necessary conditions induced by diffusion are investigated. Thirdly, optimal control theory is derived, and the adjoint system and the first-order optimization condition are established. Fourthly, parameter identification based on optimal control is studied, and the technique is extended to network structure. Finally, extensive numerical simulations, including Turing pattern, Normalized Population High Distribution Area (NPHDA) diagram and parameter identification, are carried out to illustrate and validate the analytical results. For the system dynamics phenomena, the results from different perspectives effectively demonstrate that the theoretical findings, numerical simulations and natural reality are identical. In terms of the parameter identification of continuous model and network model, the efficiency and accuracy of various algorithms are fully tested.

基于网络反应扩散系统的生态绿色行为研究及应用

Yuxuan Pan

Jiangsu University, China

为促进绿色生态经济的发展，我们通过建立反应扩散模型研究绿色行为传播机制，借

助图灵斑图理论分析方法探索连续空间与复杂网络上绿色行为传播的复杂动力学特性。进一步，构建评价绿色行为传播状态的评价指标 NPPA，并将最佳NPPA 设为理想目标。此外，为使绿色行为的传播状态尽快达到理想目标，分别利用基于投影梯度下降（PGD）算法和分支限界（BB）算法的参数识别技术设计损耗最少的最佳路径。最后，通过数值模拟方法分析绿色行为在不同网络结构中传播的差异性，并比较基于不同算法下不同网络结构参数识别的结果。研究发现，BB 算法下 BA 网络和 LA8 网络的效果较好。在模型应用方面，借助中华人民共和国生态与环境部发布的《公民生态坏境行为调查报告（2022 年）》数据验证参数识别技术的实用效应。

Optimal placement of marine protected areas for a predator–prey fish model

Yuhui Sun

Nanjing University of Information Science and Technology, China

This paper proposes a fishery model with price fluctuations and predators. Under the assumption that the price changes much faster than other variables in the system, the fishery model can be considered as a fast-slow system. Using the approximate aggregation method, a simplified three-dimensional model is used for further research. The results indicate that due to overfishing by fishermen and the presence of predators, fish populations may become extinct, which is also known as catastrophic equilibrium. To avoid this situation, we propose two solutions. The first is to establish marine protected areas (MPAs) that prohibit fishing. We propose a fish population dynamics model with MPA, assuming that fish and predators move freely in protected areas and fishing areas. The results show that it is necessary to establish MPA. The second type is that regulatory agencies can control overfishing by fishermen by increasing taxes, thereby avoiding a catastrophic equilibrium. The ultimate goal is to achieve maximum economic benefits while maintaining balanced development of the ecosystem.

Analysis of a degenerate reaction-diffusion anthrax model with spatial heterogeneity

Jinshan Wang

Nanjing University of Aeronautics and Astronautics, China

To investigate the impact of spatial heterogeneity on anthrax transmission, we develop a novel degenerate reaction–diffusion model for anthrax. Despite the lack of compactness of the solution map, the asymptotic smoothness is confirmed by examining its contractility. We establish two thresholds, $s(J)$ obtained by an auxiliary system and R_0 defined by next generation operator, corresponding to the extinction and persistence of anthrax, respectively. Additionally, we investigate the steady-state bifurcation at the disease-free equilibrium by bifurcation theory. Our numerical simulations reveal the effects of heterogeneity on the transmission of anthrax and discover a phenomenon of spatial synchronization, which maintains the invariance of the basic reproduction number. Notably, we demonstrate that synchronization is the underlying mechanism for this invariance. In summary, our findings provide valuable insights for advancing the understanding of infectious disease transmission dynamics.

Threshold dynamics and regional optimal control of a malaria model with spatial heterogeneity and ivermectin therapy

Jing Wang

Nanjing University of Aeronautics and Astronautics, China

The recent experimental results illustrate that adding ivermectin to artemisinin-based combination therapy can target malaria parasite and its vector, which may be a new treatment option. In this work, we present a new malaria transmission model, which incorporates spatial heterogeneity, general incidence rate and treatment plan with ivermectin. The basic reproduction number is introduced as a threshold parameter to determine whether malaria will eventually die out or not. Further, we propose and analyze the regional optimal control problem to minimize mosquito population, exposed and infectious humans as well as costs. Numerically, we investigate the transmission and control of malaria in The Gambia. Results show that the treatment plans with ivermectin and without ivermectin have the same contribution to the basic reproduction number, but have different effects on the epidemic level of malaria. This conclusion also holds for different incidence rates with some assumptions. Moreover, by comparing the costs and benefits of all strategies, the most cost-effective strategy is found.

An optimized AdaBoost algorithm with atherosclerosis diagnostic applications: adaptive weight-adjustable boosting

Sensen Wang

Nanjing University of Information Science and Technology, China

In this study, a new boosting algorithm was proposed based on the traditional AdaBoost algorithm to better address classification problems. While preserving the core idea of AdaBoost, the proposed algorithm introduced a parameter-controlled adjustable function to further regulate the update strength of sample weights, enhancing its robustness and improving its ability to handle challenging classification tasks. The rationality and feasibility of the improved algorithm were theoretically proven, and the optimal formula for weak classifier weights was provided. Experimental results from numerical simulations demonstrated that the proposed method significantly improved performance compared to the traditional AdaBoost algorithm on datasets containing noise features and class imbalance, especially under sample insufficient conditions. Furthermore, when combined with the RFE-RF feature selection technique and applied to real atherosclerosis data, our algorithm achieved optimal performance while retaining six important features: Triglyceride (TG), low-density lipoprotein (LDL), fasting blood glucose(FBG), white blood cell count (WBC), uric acid (UA), and left carotid artery early systolic pulse wave velocity (LCCAES). Notably, our algorithm outperformed the AdaBoost algorithm across all evaluation metrics, including accuracy, precision, recall, F1-score, and AUC, with values of 95.78%, 85.83%, 84.29%, 83.95% and 90.94%, respectively.

Sustainable management of predatory fish affected by an Allee effect through

marine protected areas and taxation

Xiaoyue Yuan

Nanjing University of Information Science and Technology, China

Ecological balance and stable economic development are crucial for the fishery. This study proposes a predator-prey system for marine communities, where the growth of predators follows the Allee effect and takes into account the rapid fluctuations in resource prices caused by supply and demand. The system predicts the existence of catastrophic equilibrium, which may lead to the extinction of prey, consequently leading to the extinction of predators, but fishing efforts remain high. Marine protected areas are established near fishing areas to avoid such situations. Fish migrate rapidly between these two areas and are only harvested in the nonprotected areas. A three-dimensional simplified model is derived by applying variable aggregation to describe the variation of global variables on a slow time scale. To seek conditions to avoid species extinction and maintain sustainable fishing activities, the existence of positive equilibrium points and their local stability are explored based on the simplified model. Moreover, the long-term impact of establishing marine protected areas and levying taxes based on unit catch on fishery dynamics is studied, and the optimal tax policy is obtained by applying Pontryagin's maximum principle. The theoretical analysis and numerical examples of this study demonstrate the comprehensive effectiveness of increasing the proportion of marine protected areas and controlling taxes on the sustainable development of fishery.

The horizontal magnetic primitive equations approximation of the anisotropic MHD equations in a thin 3D domain

Jie Zhang

Nanjing University of Information Science and Technology, China

In this paper, we give a rigorous justification of the deviation of the primitive equations with only horizontal viscosity and magnetic diffusivity (PEHM) as the small aspect ratio limit of the incompressible three-dimensional scaled horizontal viscous MHD (SHMHD) equations. Choosing an aspect ratio parameter , we consider the case that if the horizontal and vertical viscous coefficients are of and , and the orders of magnetic diffusion coefficients and are and with , then the limiting system is the PEHM as goes to zero. For -initial data, we prove that the global weak solutions of the SHMHD equations converge strongly to the local-in-time strong solutions of the PEHM, as tends to zero. For -initial data with additional regularity we slightly improve the well-posed result in [2017-Cao-Li-Titi-Global] to extend the local-in-time strong convergences to the global-in-time one. For -initial data, we show that the local-in-time strong solutions of the SHMHD equations converge strongly to the global-in-time strong solutions of the PEHM, as goes to zero. Moreover, the rate of convergence is of the order), where =min{2, with . It should be noted that in contrast to the case , the case has been investigated by Du and Li, in which they consider the PEM and the rate of global-in-time convergences is of the order .

Exploring the impact of socioeconomic and natural factors on pulmonary

tuberculosis incidence in China (2013–2019) using explainable machine learning: A nationwide study

Jiaxin Zhao

Zhengzhou University, China

Pulmonary tuberculosis (PTB) stands as a significant and prevalent infectious disease in China. Integrating 13 natural and socioeconomic factors, we conduct nine machine learning (ML) models alongside the Tree-Structured Parzen Estimator to predict the monthly PTB incidence rate from 2013 to 2019 in mainland China. With explainable ML techniques, our research highlights that population size, per capita GDP, and PM10 concentration emerge as the primary determinants influencing the PTB incidence rate. We delineate both the independent and interactive impacts of these factors on the PTB incidence rate. Furthermore, crucial thresholds associated with factors influencing the PTB incidence rate are identified. Taking factors that have a positive effect on reducing the incidence rate of PTB as an example, the thresholds at which the effects of factors PM2.5, PM10, O3, and RH on the incidence rate change from increase to decrease are 105.5 μg/m3, 75.5 μg/m3, 90.8 μg/m3, and 72.3 % respectively. Our work will contribute valuable insights for public health interventions.

Predator invasion in a spatially heterogeneous predator-prey model with group defense and prey-taxis

Zidie Zhang

Anqing Normal University, China

This paper mainly studies a spatial predator-prey model with group defense and prey-taxis. The stability of the semi-trivial solution is examined by employing variational formulations and using the limiting behavior for the principal eigenvalue. Six different parametric restrictions dependent on the environmental carrying capacity are discussed to explore the effect of the prey-taxis and prey diffusion on the stability of the semi-trivial solution. Our analysis reveals that prey-taxis can change the stability of the semi-trivial solution in particular cases. Moreover, it is obtained that as long as the predator death rate is small enough, the predator can successfully invade no matter how the prey disperses. Numerical simulations illustrate that prey-taxis, group defense and environmental heterogeneity may have a synergistic effect on promoting predator invasion. It is determined that the intensity of environmental heterogeneity can affect the population size, and the predator may fail to invade due to the high environmental heterogeneity. Note that group defense plays a positive role in predator invasion.

Time periodic weak solution to incompressible generalized newtonian fluid with an elastic plate

Yongqing Zhao

Nanjing University of Information Science and Technology, China

In this paper, we investigate the periodic weak solution to the coupling problem between a generalized Newtonian fluid and an elastic shell. We employ the energy method for a priori

estimation, resulting in a uniformly bounded energy estimate. Given that the moving domain depends on the solution itself, we introduce regularization operators to decouple, regularize, and linearize the system. Subsequently, we discretize in time to construct an approximate solution and estimate its accuracy. Because the initial conditions are periodic, we utilize the Brouwer fixed point theorem to verify the periodicity of the approaching solution. Lastly, based on the monotone operator theory, we establish the existence of the weak solution for the entire decoupling system by considering the limit of the approaching system. We apply the Kakutani-Glicksberg-Fan fixed point theorem to recover the weak solution of the decoupled system. Ultimately, we obtain the time-periodic weak solution of the original system by considering the limit of the regularization parameters.

Dynamical behavior of the fecal-oral transmission diseases model on a T-periodic evolution domain

You Zhou

Yangzhou University, China

We study the transmission dynamics of a fecal-oral diseases model on a T-periodic evolution domain. We introduce the basic reproduction number as a threshold by some operator semigroup theory and give the relationship between it and that of the fixed domain, where is the domain evolution rate. By means of upper and lower solutions method, we investigate the existence, uniqueness and attractivity of endemic and disease-free equilibria respectively. Under certain conditions, there exists a unique global asymptotically stable positive periodic solution if . When , the model possesses only zero solutions and is globally asymptotically stable. The final numerical simulations further verify our conclusions and illustrate the effect of the evolution rate. Based on the index , compared with the model on a fixed domain, we show that the transmission risk of the diseases increases if the index is lower than 1 and the risk decreases if the index is equal or greater than 1.

A Brief Introduction to the SMS of NUIST

School of Mathematics and Statistics, Nanjing University of Information Science and Technology (NUIST), China

About NUIST

NUIST, formerly named **Nanjing Institute of Meteorology**, was established in 1960 and enjoys the reputation as "the cradle of meteorological talents in China".

In 1978: Listed as one of the 88 National Key Universities in China.

In 2004: Renamed as **Nanjing University of Information Science & Technology**.

In 2017: Selected as National "Double-First-Class" Construction University.

Rankings: #41 in Best Global Universities in China / #511 in Best Global Universities (U.S. News);

#50-71 in Mainland China / #401-500 in World-University-Rankings-2020 (ARWU).

A^+: Meteorology was ranked Top 1 in subject assessment by the MOE and rated A^+ in China.

About School of Mathematics and Statistics

The School of Mathematics and Statistics (SMS) in NUIST, is eligible to offer Master's and PhD programs in **Mathematics**, Professional Master's program in **Applied Statistics**, as well as postdoctoral positions of Mathematics. **Mathematics** is the key discipline of China Meteorological Administration.

The School also offers three undergraduate majors including Mathematics and Applied Mathematics (MAM), Information and Computing Science (ICS), and Applied Statistics (AS), which are all key majors of Jiangsu Province, China. ICS and AS were selected as the **First-class** undergraduate major by the MOE.

Rankings: #30 in Mathematics **in China** / #166 in Mathematics (U.S. News);

49-75 in Mathematics **in mainland China** / #301-400 in Mathematics (ARWU).

Faculty: The School has personnel of highly qualified teachers with strong research capabilities. The School currently has over 110 faculty members, including 32 professors and 21 PhD supervisors, 41 associate professors / associate researchers.

Honor & Awards:

- Norbert Gerbier-Mumm International Award, World Meteorological Organization (2001)

- National Thousand Talents Program, Fok Ying-Tong Education Foundation, Distinguished Professor of Jiangsu Province, etc.
- Outstanding award in COMAP's Mathematical Contest in Modeling (MCM) / Interdisciplinary Contest in Modeling (ICM) (2012, 2018, 2019, 2022)
- The only prize of the highest rank, namely the Higher Education Press Cup, in the National Mathematical Modeling Contest for undergraduates (2011)


南京信息工程大学

学　生：周敏强
黄　思
盛振峰

指导老师：曹春正

荣获二零一一年高教社杯全国大学生数学建模竞赛本科组一等奖并荣获高教社杯。

2012
Interdisciplinary Contest In Modeling
Certificate of Achievement
Be It Known That The Team Of
Yizhou Zhuang
Senfeng Liu
Liusi Xiao
With Faculty Advisor
Guosheng Cheng
of
Nanjing University of Information Science and Technology
Was Designated As
Outstanding Winner

2018
Interdisciplinary Contest In Modeling
Certificate of Achievement
Be It Known That The Team Of
Haixu Hong
Mengshi Cui
Shu Liu
With Faculty Advisor
Lianhua Zhu
of
Nanjing University of Information Science & Technology
Was Designated As
Outstanding Winner

- The first class award for National teaching achievement by the MOE (2014)
- The first class award for teaching achievement of Jiangsu Province (2011, 2017)
- 2 National first-class undergraduate courses (2023)
- Many awards as national brand curriculum, excellent curriculum of Jiangsu Province, key textbook of Jiangsu Province, excellent textbook of China Meteorological Administration

Research in School of Mathematics and Statistics

Research Areas and Features:

- We focus on the problem-driven theoretical research, and a strong research team has been formed in the fields of fluid dynamics, scientific calculation, statistical inference, time series, algebra and number theory, etc.
- We emphasize on the intersection and integration with the atmospheric sciences, develop mathematical technology to solve key problems in interdisciplinary research, and carry out

extensive and in-depth research on the application of multiple linear models to typhoon diagnosis, the application of control theory to data assimilation, earth system model and other atmospheric mathematics, etc.

Platform: The National center for applied mathematics (jointly), the Jiangsu center for applied mathematics, Jiangsu Research Base for Statistics, Jiangsu Joint Laboratory for International Cooperation, Jiangsu Foreign Experts Studio and 5 Jiangsu Enterprise graduate workstations, which can provide excellent social resource for enhancing the students' innovation and enterprise ability.

International and Industrial Collaboration: On average, about 30 mathematicians or business experts from around the world visit the School each year for 2 to 4 weeks, conducting joint research with local mathematicians and statisticians, holding seminars, and making themselves available for consultation with students working in their area. Through teaching partnership and active cooperative research projects, the School has close ties with the industry such as Huawei and Neusoft.

Fund: In the past five years, the academic team of the School has received 55 National projects and 76 other level projects, including 973 Program, National Key Research and Development Program of China, Key Program of NSFC and so on, altogether 39.8 million (CNY).

Publications: More than 400 papers in SCI journals like **Trans. Amer. Math. Soc.**, **Adv. Math.**, **J. Funct. Anal.**, **Sci. China Math.**, **Arch. Ration. Mech. Anal.**, **SIAM** journals, **IEEE** journals, etc, and more than 30 monographs and textbooks, in the past five years.

Education in School of Mathematics and Statistics

Aims: Advancing mathematical and statistical knowledge through novel and insightful research. Training experts in not only mathematics but also other academic, industrial, and applied fields.

International Joint Training Program: International cooperation with **University of Reading**, **Florida State University, Carleton University**, etc., carrying out joint enrollment and training of undergraduate, master and PhD students, as well as regular academic exchanges.

Employment and Further Education: High quality employment rate is over 98.2%, including research, teaching and technology development in the field of government agencies, research institution, education, IT, meteorology, finances and so on. The rate of studying abroad as a postgraduate is over 30%, and many graduates have been enrolled in domestic and foreign famous universities such as **Cornell University**, **University of Edinburgh**, **Columbia University**, **Imperial College London**, **Tsinghua University**, **Chinese Academy of Sciences**, etc.

Future of Our Students: The School cultivates a number of prominent alumni including "Special National Experts" and tenured professors in USA and European countries, and makes important contributions in the field of numerical prediction, climatic statistics, data assimilation and the application of differential equation, etc.

Website: https://math.nuist.edu.cn/3305/list.htm Email address: sms@nuist.edu.cn

Team Introduction

Biomathematics and Applied Differential Equations Team

The team focuses on theory of differential equations, control methods and numerical inversion algorithms, and applied them to complex fluids, biomathematics and data assimilation, which promotes the theoretical development and efficient applications in meteorological satellite data assimilation. In the past five years, the research results are published in *Adv. Math., ARMA, JDE, JFA, CPDE, CVPDE, SIAM, MB* and other journals, a total of 98 SCI papers. The team has carried out 17 projects of National Natural Science Foundation of China and 5 projects of Science and Technology Plan of Jiangsu Province. The team has won the first prize of Educational Science Research Achievement of Jiangsu Province (Science and Technology Research Category), Mathematics Achievement Award of Jiangsu Province, Youth Award of Jiangsu Society for Industrial and Applied Mathematics, etc.

Principal members

- **Biomathematics**

Qi An (安琪), Kewang Chen (陈克旺), Guangping Hu (胡广平), Yong Jiang (蒋勇), Wenjun Liu (刘文军), Xuebing Zhang (张学兵)

- **Applied Differential Equations**

Rong Chen (成荣), Xueping Huang (黄学平), Temesgen Desta Leta, Zijin Li (李子劲), Yan Li (李琰), Yaning Li (李亚宁), Guangying Lv (吕广迎), Anum Shafiq, Xingdong Tang (唐兴栋), Yanqin Xiong (熊艳琴)

- **Inverse Problem and Control of Differential Equations**

Shunjie Li (李顺杰), Yuchan Wang (王玉婵), Bin Wu (吴斌), Xiaochuan Xu (徐小川)

- **Applications in Image Processing**

Yunjie Chen (陈允杰), Jingshi Li (李景诗), Qianting Ma (马倩婷), Weiwei Xu (徐玮玮)

Representative research projects in the past six years

Wenjun Liu, National Natural Science Foundation of China (Grant No. 11771216) "Mathematical models and dynamics of nonlinear wave propagation in viscoelastic biological tissues", 2018.01-2021.12

Weiwei Xu, National Natural Science Foundation of China (Grant No. 11971243) "Correlation matrix calculation in gene expression data analysis", 2020.01-2023.12

Guangying Lv, National Natural Science Foundation of China (Grant No. 12171247) " Research on stochastic partial differential equations with multiple scales", 2022.01-2025.12

Bin Wu, National Natural Science Foundation of China (Grant No. 12171248) " Inverse

problems and numerical methods in stochastic cardiac electrophysiological System", 2022.01-2025.12

Wenjun Liu, National Natural Science Foundation of China (Grant No. 12271261)" Mathematical Model and Dynamics of Atherosclerosis Based on pulse wave", 2023.01-2026.12

Shunjie Li, National Natural Science Foundation of China (Grant No. 61573192) "Differential flatness of affine nonlinear systems and related problems", 2016.01-2019.12

Yunjie Chen, National Natural Science Foundation of China (Grant No. 61672291) "Research on hippocampus segmentation of multimodal infant brain MRI images", 2017.01-2020.12

Temesgen Desta Leta, National Natural Science Foundation of China for Foreign Young Scholars (Grant No. 11950410502) “Studies on singular nonlinear wave wquations: a dynamical systems approach”, 2020.01-2021.12

Yanqin Xiong, National Natural Science Foundation of China (Grant No. 11701289) "Qualitative analysis and bifurcation of limit cycles for several nonlinear systems", 2018.01-2020.12

Yaning Li, National Natural Science Foundation of China (Grant No. 11801276), "Fujita critical index for fractional superdiffusion equations", 2019.01-2021.12

Shengqian Chen, National Natural Science Foundation of China (Grant no. 11901306) " Model based on artial differential equation for the association between intra-seasonal oscillation of tropical atmosphere and subtropical climate", 2020.01-2022.12

Yuchan Wang, National Natural Science Foundation of China (Grant No. 11901308) "Inverse problems and numerical implementation of nonlinear parabolic equations with nonlocal diffusion coefficients", 2020.01-2022.12

Qianting Ma, National Natural Science Foundation of China (Grant No. 61902192) "Ultrasonic image segmentation of breast tumors based on superpixel analysis and unsupervised clustering model", 2020.01-2022.12

Kewang Chen, National Natural Science Foundation of China (Grant No. 12001287) "Study on fluid-structure interaction model for nonlinear wave propagation in arterial blood flow", 2021.01-2023.12

Qi An, National Natural Science Foundation of China (Grant No. 12101318) "Study on pattern dynamics of population model with memory chemotaxis" 2022.01-2024.12

Yan Li, National Natural Science Foundation of China (Grant No. 12201308) "Study on Symmetry and Existence of Solutions of Nonlocal Pseudo-differential Operator Equations" 2023.01-2025.12

Jingshi Li, National Natural Science Foundation of China (Grant No. 12201310) "An Efficient Numerical Method for Optimal Control Problems of Stochastic Navier-Stokes Equations " 2023.01-2025.12

Yaning Li, Mathematics Tianyuan Foundation of National Natural Science Foundation

of China (Grant No. 11626132) "Existence of Periodic Solutions of Fractional Laplace Equation", 2017.01-2017.12

Wenjun Liu, Key Research and Development Program of Jiangsu Province of China (Social Development) (Grant No. BE2019725) "Non-invasive detection of cardiovascular disease based on pulse wave information", 2019.07-2022.06

Wenjun Liu, Mathematics Tianyuan Foundation of National Natural Science Foundation of China (Grant No. 11926315) "Advanced seminar of fluid-structure interaction and its applications in medical diagnosis", 2020.01-2020.12

Rong Cheng, Mathematics Tianyuan Foundation of National Natural Science Foundation of China (Grant No. 12226412) "Workshop on Tianyuan Mathematics of Differential Dynamic Systems and Variational Methods", 2023.01-2023.12

Wenjun Liu, Jiangsu Natural Science Foundation (Grant No. BK20151523) "Dynamic analysis and stability control of time-delay dissipative viscoelastic systems", 2015.07-2018.06

Xuebing Zhang, Jiangsu Natural Science Foundation (Grant No. BK20150420) "Dynamic analysis and control of time-delay reaction-diffusion population model", 2015.07-2018.06

Representative research achievements in the past six years

Xuebing Zhang etc., Dynamics analysis of a delayed reaction-diffusion predator-prey system with non-continuous threshold harvesting, **Math. Biosci.**, 2017.

Zijin Li etc., Regularity of weak solutions of elliptic and parabolic equations with some critical or supercritical potentials, **J. Differential Equations**, 2017.

Qianting Ma etc., A fractional differential fidelity-based PDE model for image denoising, **Mach. Vision and Appl.,** 2017.

Xingdong Tang etc.，Stability of the traveling waves for the derivative Schrodinger equation in the energy space, **Calc. Var. Partial Differential Equations**, 2017.

Wenjun Liu etc., A note on blow-up of solution for a class of semilinear pseudo-parabolic equations, **J. Funct. Anal.**, 2018.

Qi An etc.. Geometric stability switch criteria in two-delay differential systems with delay dependent parameters, **J. Differential Equations**, 2018.

Xingdong Tang etc., Stability of the sum of two solitary waves for (gDNLS) in the energy space, **J. Differential Equations**, 2018.

Guangying Lv etc., Kinetic solutions for nonlocal scalar conservation laws, **SIAM J. Math. Anal.**, 2018.

Xuebing Zhang etc., Dynamics and pattern formation of a diffusive predator–prey model in the presence of toxicity, **Nonlinear Dynam.**, 2019.

Wenjun Liu etc., Stabilization of a thermoelastic laminated beam with past history, **Appl.**

Math. Optim., 2019.

Guangying Lv etc., BMO and Morrey-Campanato estimates for stochastic convolutions and Schauder estimates for stochastic parabolic equations, **J. Differential Equations**, 2019.

Shunjie Li etc., Maximal feedback linearization and its internal dynamics with applications to mechanical systems on R4, **Int. J. Robust Nonlinear Control.**, 2019.

Qi An etc., Dynamics and pattern formation of a diffusive predator-prey model in the presence of toxicity, **Discrete Contin. Dyn. Syst.**, 2020.

Yunjie Chen etc., Quasi Fourier-Mellin Transform for Affine Invariant Features, **IEEE Trans. Image Process**, 2020.

Bin Wu etc., Carleman estimates for a stochasticdegenerate parabolic equation and applications to null controllability and an inverse random source problem, **Inverse Probl.**, 2020.

Yanqin Xiong etc., Limit cycle bifurcations by perturbing a class of planar quintic vector fields, **J. Differential Equations**, 2020.

Xiaochuan Xu etc., On the inverse spectral stability for the transmission eigenvalue problem with finite data, **Inverse Probl.**, 2020.

Xuebing Zhang etc., Spatiotemporal dynamics of a delayed diffusive ratio-dependent predator–prey model with fear effect, **Nonlinear Dynam.**, 2021.

Yanqin Xiong etc., The maximal number of limit cycles bifurcating from a Hamiltonian triangle in quadratic systems, **J. Differential Equations**, 2021.

Xiaochuan Xu etc., On the stability of the inverse transmission eigenvalue problem from the data of McLaughlin and Polyakov, **J. Differential Equations**, 2022.

Wenjun Liu etc., The strong solutions to the primitive equations coupled with multi-phase moisture atmosphere, **Phys. D**, 2022.

Xingdong Tang etc., Instability of the solitary waves for the 1d NLS with an attractive delta potential in the degenerate case. **Math. Res. Lett.**, 2022.

Guangying Lv etc., Stochastic transport equation with bounded and Dini continuous drift, **J. Differential Equations**, 2022.

Xuebing Zhang etc., Global stability of a rumor spreading model with discontinuous control strategies. **Phys. A**, 2022.

Zijin Li etc., Constrained large solutions to Leray's problem in a distorted strip with the Navier-slip boundary condition, **J. Differential Equations**, 2023.

Zijin Li, A refined long time asymptotic bound for 3D axially symmetric Boussinesq system with zero thermal diffusivity, **J. Differential Equations**, 2023.

Xingdong Tang etc., Instability of the solitary waves for the generalized derivative nonlinear Schrödinger equation in the degenerate case, **J. Differential Equations**, 2023.

Xueping Huang, Semi-linear elliptic inequalities on weighted graphs, **Calc. Var. Partial**

Differential Equations, 2023.

Xingdong Tang etc., Minimal mass blow-up solutions for the L2 -critical NLS with the delta potential for even data in one dimension, **SIAM J. Math. Anal.**, 2024.

Zijin Li etc., Finite speed axially symmetric Navier-Stokes flows passing a cone, **J. Funct. Anal.**, 2024.

Zijin Li etc., On Leray's problem in an infinitely long pipe with the Navier-slip boundary condition, **Sci. China Math.**, 2024.

Published Textbooks

Wenjun Liu, Yuepeng Wang, Feida Jiang etc. **Equations of Mathematical Physics: Models, Methods and Applications (2nd)**, Science Press, 2021. (Welcome to join QQ group **933354732** for teaching discussion)

Gang Li, Wenjun Liu, Feida Jiang etc. **Equations of Mathematical Physics: Models, Methods and Applications**, Science Press, 2017.

Wenjun Liu, Jian Ding, Rong Cheng and Shengqi Yu, **Ordinary Differential Equations-Theory, Methods and Applications**, World Academic Press, 2013.

Online MOOC

Differential Equation (masters), National postgraduate education wisdom education platform, https://www.gradsmartedu.cn/course/nuistP04011A66899 (suitable for postgraduate students majoring in Mathematics)

Equations of Mathematical Physics (research includes), National postgraduate education wisdom education platform, https://www.gradsmartedu.cn/course/nuistP04011A53524 (suitable for undergraduate students majoring in Mathematics, and non-mathematical postgraduate students majoring in Applied Meteorology et al.)

Equations of Mathematical Physics, Chinese University MOOC, https://www.icourse163.org/course/NUIST-1461957161?tid=1470000446 (suitable for undergraduate students majoring in Atmospheric science, Electronic Information and Mathematics et al.)

Traffic Guidance

（We look forward to your guidance at any time）

Campus Tour Bus and Station

（1 元/次，可使用支付宝或微信）

祝您生活愉快！

Wish you a happy life.