2023 年微分方程理论及应用研讨会

为加强湖南第一师范学院数学学科的建设和发展，增强微分方程方向同行之间的联系和合作，计划于 2023 年 4 月 21 日在湖南第一师范学院举办微分方程及应用研讨会。

主办单位：湖南第一师范学院数学与统计学院

会议地点：湖南第一师范学院数学与统计学院会议室

会议时间：2023 年 4 月 21 日

会 议 日 程

时间	报告专家	报告题目
9:00-9:30	李继彬	Models of shallow water wave equations having peakons, periodic peakons and compactons
9:30-10:00	韩茂安	比较定理的改进与应用
10:00-10:30	庾建设	Wolbachia spread dynamics in mosquito populations under period switching environment conditions
10:30-11:00	邓圣福	One- and two-hump solutions of a singularly perturbed cubic nonlinear Schrödinger equation
11:00-11:30	周　展	Discrete boundary value problems involving the mean curvature operator
11:30-12:00	郭志明	Global dynamics of a class of delayed differential systems with spatial non-locality
12:00-12:30	郑　波	A mosquito population suppression model with a saturated Wolbachia release strategy in seasonal succession
12:30-13:40		中餐
15:00-15:30	孙俊涛	Standing waves for the NLS equation with competing nonlocal and local nonlinearities: the double L^2-supercritical case
15:30-16:00	李先义	Global dynamics for a rational difference equation with higher order and solutions to several “Open Problem and Conjectures”
16:00-16:30	张再云	Long time dynamics of the damped forced generalized Ostrovsky equation with below Energy space
16:30-18:00		座谈交流
18：00		晚餐

报告摘要与专家简介:

Models of shallow water wave equations having peakons, periodic peakons and compactons

李继彬

华侨大学

Abstract：Water waves in channels and oceans are usually described by the Euler equations. Due to their complexity, several approximate models have been derived in various wave regimes. Indeed, considering long waves propagating in shallow water but without assuming small amplitudes, Serre derived a fully nonlinear weakly dispersive system of equations which, with some approximations, include the Korteweg-de Vries, Saint-Venant and Boussinesq equations as special cases. In 2010，Dias and Milewski presented a generalization of the Serre equations, which are fully-nonlinear, weakly dispersive and bidirectional (orisotropic) equations under a built-in assumption of irrotationality. It is very interesting that the corresponding traveling systems of these water wave models are singular traveling wave systems. In this talk, we state how to use the dynamical system approach to study the peakon, periodic peakon and compacton families for these water wave models.

专家简介：李继彬，华侨大学和浙江师范大学特聘教授，博士生导师，动力系统与非线性研究中心负责人，国家级突出贡献专家, 1991 年获首届国务院特殊津贴. 曾任四届国家自然科学基金委数学学科评审专家组成员，三届云南省数学会理事长，昆明理工大学理学院院长等。 现为《应用数学与力学》等全国和国际性刊物的编委；美国《数学评论》与德国《数学文摘》评论员。主持承担国家自然科学基金重点项目和面上项目等 10 余项，发表论文 250 余篇，在“科学出版社”等出版中英文专著 10 余部，主编教材两部、出版科普书两本。三十余年培养硕士和博士研究生 70 余人. 科研成果曾分别获云南省和浙江省科学技术一等奖. 先后二十余次应邀到美国、俄国, 法国、加拿大、德国、英国、澳大利亚、西班牙、新加坡,南非等国家和香港, 澳门，台湾等地区多所大学和研究机构进行科研合作与学术交流。

比较定理的改进与应用

韩茂安

浙江师范大学

报告摘要：对熟知的比较定理给出一个改进,可用来给出平面系统从某一简单闭曲线上出发的轨线都进入其内或其外的判定条件,从而可用来严格化平面环域定理的应用

专家简介：韩茂安，浙江师大、上海师大（已退休），二级教授，博士生导师，1994 年被人事部授予国家中青年有突出贡献专家称号，2004 年获得教育部新世纪优秀人才支持计划，2005 年获得上海市优秀学科带头人支持计划。目前主持国家自然科学基金重点项目，多次主持国家自然科学基金面上项目，作为第一完成人分别获得教育部科技进步一等奖、上海市自然科学二等奖、宝钢基金优秀教师奖、上海市教学成果二等奖，培养博士和博士后 60 多人， 发表 SCI 论文 300 多篇， 教学研究论文 10 多篇， 在国内外出版专著和教材 10 余部。作为主编分别在上海交大、上海师大与浙江师大三所大学创办三家国际数学杂志 Communication on Pure and Applied Analysis(CPAA)、Journal of Applied Analysis and Computation(JAAC)、Journal of Nonlinear Modeling and Analysis(JNMA)，以上杂志均入选中国数学会的数学领域高质量科技期刊分级目录。

Wolbachia spread dynamics in mosquito populations under period switching environment conditions

庾建设

广州大学

Abstract： There is currently great interest in releasing Wolbachia-infected Aedes mosquitoes worldwide to replace wild ones and mitigate arbovirus transmission. For Wolbachia establishment in natural field populations, we should consider the impact of environmental heterogeneity. To the end, we develop a discrete periodic switching model to characterize the Wolbachia spread dynamics in mosquito populations with non-overlapping generations, where the environmental change is periodic. The introduction threshold of Wolbachia-infected mosquitoes that must be surpassed for Wolbachia establishment is located, together with the location of that infection will ultimately reach. When the environments switch periodically, we find that the

introduction threshold becomes an unstable periodic solution, and the infection will ultimately reach a stable periodic solution when maternal transmission is imperfect. Our model not only includes all the existing work since 1959, but also raises some theoretical questions that need further investigations.

专家简介：庾建设，教授，博士生导师，国家杰出基金获得者，国家有突出贡献的中青年专家，国家“百千万人才工程”第一层次、第二层次人选，教育部跨世纪优秀人才，享受政府特殊津贴专家，广州大学应用数学研究中心主任。庾建设教授长期从事微分方程动力系统、差分方程及生物数学模型的理论与应用研究，先后主持国家自然科学基金项目 10 余项，其中重点项目 3 项，数学交叉研究平台项目 2 项；曾获国家级教学成果一等奖 1 项，省部级科技成果、教学成果一等奖 3 项；2020 年获得广东省科学技术奖自然科学奖一等奖。近十年来，致力于应用数学的理论研究及其在基因表达、蚊媒传染疾病防控等方面的应用，已在《Nature》、《PLoS Comput. Biol.》、《J. Differential Equations》、《SIAM J. Appl. Math.》、《J. Math. Biol.》、《J. Theor. Biol.》等重要数学、应用数学国际刊物发表论文多篇。

One- and two-hump solutions of a singularly perturbed cubic nonlinear Schrödinger equation

邓圣福

华侨大学

Abstract： This talk considers the existence of one- or two-hump solutions of a singularly perturbed nonlinear Schrödinger (NLS) equation, which is the standard NLS equation with a third order perturbation. In particular, this equation appears in the field of nonlinear optics, where it is used to describe pulses in optical fibers near a zero dispersion wavelength. It has been shown formally and numerically that the perturbed NLS equation has one- or multi-hump solutions with small oscillations at infinity, called generalized one- or multi-hump solutions. The main purpose here is to provide the first rigorous proof of the existence of generalized one- or two-hump solutions of the singularly perturbed NLS equation. The several invariant properties of the equation, i.e., the translational invariance, the gauge invariance and the reversibility property, are essential to obtain enough free constants to prove the

existence. The ideas and methods presented here may be applicable to show existence of generalized 2^k-hump solutions of the equation.

专家简介：邓圣福，华侨大学教授，“闽江学者奖励计划”特聘教授，主要研究微分方程与动力系统理论及其在水波问题上的应用。先后主持国家自然科学基金面上项目 3 项、福建省和广东省自然科学基金多项，曾入选广东省“扬帆计划”引进紧缺拔尖人才、广东省高等学校“千百十人才培养工程”省级培养对象等。在 Arch. Rational Mech. Anal.、SIAM J. Math. Anal.、Nonlinearity、J. Differential Equations、Physica D 等国际重要学术期刊上发表论文 40 多篇。

Discrete boundary value problems involving the mean curvature operator

周展

广州大学

Abstract： In this talk, we will introduce some results on the positive solutions for some nonlinear discrete Dirichlet boundary value problems involving the mean curvature operator by using critical point theory. First, some sufficient conditions on the existence of infinitely many positive solutions are given. We show that, the suitable oscillating behavior of the nonlinear term near at the origin and at infinity will lead to the existence of a sequence of pairwise distinct nontrivial positive solutions. Then, the existence of at least two positive solutions is established when the nonlinear term is not oscillatory both at the origin and at infinity. Examples are also given to illustrate our main results at last.

专家简介：周展，1965 年 10 月出生，湖南长沙人，博士、二级教授、博士生导师，教育部“长江学者和创新团队发展计划”创新团队带头人，享受国务院政府特殊津贴专家，广州市“优秀专家”，中国数学会理事。现任广州大学应用数学研究中心执行主任。1985 年 7 月毕业于湘潭大学数学系获学士学位，1988 年 7 月毕业于湖南大学应用数学专业获硕士学位并留校任教，1998 年 6 月获湖南大学应用数学专业博士学位。1999 年 6 月破格晋升为教授，2003 年 12 月被遴选为博士生导师。受国家留学基金委资助，2000 年 9 月前往加拿大访问一年。2004 年 10 月被引进到广州大学工作，2011 年 7 月应邀在香港城市大学访问 1 个月，2014 年 7 月-8 月应邀访问加拿大罗瑞尔大学、西安大略大学、新布伦瑞克大学。

先后主持长江学者和创新团队发展计划 2 项、国家自然科学基金 7 项、教育部优秀青年教师资助计划、高等学校博士点基金等科研项目多项。近年来在《J. Differential Equations》、《Nonlinearity》、《Physica D》和《中国科学》(英文版)等重要刊物发表高水平科研论文 100 多篇，先后获得广东省自然科学一等奖(第三)、湖南省科技进步一等奖(第五)、湖南省自然科学优秀论文一等奖、第五届“秦元勋数学奖”、广东省高等学校“千百十人才培养工程”第六批先进个人。

Global dynamics of a class of delayed differential systems with spatial non-locality

郭志明

广州大学

Abstract： In this talk, we will study the global dynamics of a class of delayed differential systems with spatial non-locality. We focus on three cases: quasimonotone nondecreasing case, mixed quasimonotone case and non-quasimonotone case. For the quasimonotone nondecreasing case, by using the extended maximum principle and the method of upper and lower solutions, we obtain certain monotonicity of maximal and minimal solutions and the global attractivity of steady states. For the mixed quasimonotone case, by using the technique of introducing appropriate relaxation variables, we obtained some sufficient conditions which ensure the convergence of time-dependent solutions to a steady-state solution. For the non-quasimonotone case, by introducing some appropriate relaxation variables and employing the results for mixed quasimonotone case, we obtain some sufficient conditions which ensure the convergence of time-dependent solutions to a steady-state solution. As far as we know, this is the first attempt to study the non-quasimonotone case by using the above approach.

专家简介：郭志明，广州大学数学与信息科学学院二级教授、博士生导师。2001 年博士毕业于中山大学，2009 年在加拿大西安大略大学访问一年。多年来一直从事离散系统、泛函微分方程及生物数学模型的理论与应用研究，在 JDE、J. London Math. Soc.、JDDE、JMB、《中国科学》等国际国内重要刊物上发表论文 80 多篇，其中 SCI 收录 60 多篇。先后主持国家自然科学基金面上项目 4 项、参

加国家自然科学基金重点项目 1 项。获得 2021 年度广东省自然科学奖一等奖（排名第二）。

A mosquito population suppression model with a saturated Wolbachia release strategy in seasonal succession

郑波

广州大学

Abstract：Releasing Wolbachia-infected male mosquitoes to suppress wild female mosquitoes through cytoplasmic incompatibility has shown great promise in controlling and preventing mosquito-borne diseases. To make the release logistically and economically feasible, we propose a saturated release strategy, which is only implemented during the epidemic season of mosquito-borne diseases. Under this assumption, the model becomes a seasonally switching ordinary differential equation model. The seasonal switch brings rich dynamics, including the existence of a unique periodic solution or exactly two periodic solutions, which are proved by using the qualitative property of the Poincare map. Sufficient conditions are also obtained for determining the stability of the periodic solutions.

专家简介：郑波，博士，教授，博士生导师。主要从事常微分方程、泛函微分方程及生物数学模型的理论与应用研究，在《Nature》、《SIAM Journal of Applied Mathematics》、《Journal of Mathematical Biology》、《中国科学》、《Journal of Differential Equations》、《Journal of Dynamics and Differential Equations》、《Journal of Theoretical Biology》、《Theoretical Population Biology》等国际国内重要刊物上发表论文 40 余篇。先后主持国家自然科学基金 4 项、广州市教育局 3 项，2014 年入选广东省高校优秀青年教师培育对象，是教育部创新团队“泛函微分方程及相关问题”的骨干成员。 获得首届秦元勋青年数学奖。

Standing waves for the NLS equation with competing nonlocal and local nonlinearities: the double L2-supercritical case

孙俊涛

山东理工大学

Abstract：In this talk, we investigate the NLS equation with competing Hartree-type and power-type nonlinearities. We establish conditions for the local well-posedness in

the energy space. Under the double L2-supercritical case, we prove the existence and multiplicity of standing waves with prescribed mass by developing a constraint method. Moreover, we prove weak orbital stability and strong instability of standing waves by considering a suitable local minimization problem and by analyzing the fibering mapping, respectively. A new analysis of the fibering mapping is performed in this work. The lower bound rate of blow-up solutions for the Cauchy problem is given as well. Due to the different "strength" of the two types of nonlinearities, we find some essential differences in our results between two different competing cases. Additionally, the competing pure power-type nonlinearities case can be derived from our study thanks to a good choice of the kernel of the Hartree term.

专家简介：孙俊涛，教授、博导，山东理工大学数学与统计学院执行院长，山东省泰山学者青年专家，山东省杰青。2011 年 6 月获中南大学理学博士学位，2018 年底破格晋升教授。主要从事偏微分方程、动力系统的理论研究，在 SIAM J. Math. Anal.、J. Differential Equations、Nonlinearity、Sci. China Math.等国内外知名数学期刊发表 SCI 论文 50 余篇，主持（完成）国家自然科学基金面上项目、青年基金，山东省杰青等省部级以上项目 8 项，获 2018 年度山东省自然科学二等奖（排名 1）。

Global dynamics for a rational difference equation with higher order and solutions to several "Open Problem and Conjectures"

李先义

浙江科技学院

Abstract： In this talk we show that the unique non-negative equilibrium point of a rational difference equation with higher order is globally asymptotically stable. As application, our results not only improve many known results, but also completely solve several "Open Problem and Conjectures" presented by famous mathematicians--Professors G.Ladas and E.Camouzis.

专家简介：李先义，博士，二级教授，博士生导师，浙江省"钱江学者"特聘教授，浙江科技学院"科大学者"；华东师范大学本、硕、博，法国里尔科技大学博士后；现为浙江科技学院教授,非线性分析研究所所长,九三学社浙江科技学院委员会副主委。至今发表科研论文 110 余篇（SCI 收录 64 篇，EI 收录 31 篇），

主持科研项目 20 余项（国家级 4 项）；先后被评为“湖南省青年骨干教师”、“湖南省新世纪‘121’人才工程”人选、“湖南省学科带头人”、“广东省‘千百十’人才工程省级培养对象”等；获“湖南省高校科技工作先进工作者”、“上海市研究生优秀成果”（优博）、全国第三届“秦元勋常微分方程奖”等科研奖励与荣誉 20 多项。担任中国博士后科学基金，国家自然科学基金，“万人计划”，“双千计划”，湖南、广东、四川、重庆、江西、宁夏等省市自然科学基金，湖南省优秀硕士论文，湖南省科技进步奖，广东省科学技术奖等的通讯评审专家与会议评审专家。担任多个国际期刊的主编、副主编、荣誉编委、编委，美国《Mathematical Review》特约评论员，《Advances in Applied Mathematics》特聘审稿专家，教育部学位与研究生教育发展中心评估处专家，浙江省数理医学学会生物数学专委会副主任；IJBC, JMAA, Nonlinear Dynamics 等 50 余种科研期刊的审稿专家。先后应邀访问法国 Haute Alsace 大学、德国 Ulm 大学、复旦、上海交大等 40 多所名校。参加国际国内学术会议 30 多次，作大会报告与主持大会报告多次；主办国际国内学术会 8 次。

Long time dynamics of the damped forced generalized Ostrovsky equation with below Energy space

张再云

湖南理工学院

Abstract： In this talk, first, by using Fourier restriction norm method and Tao's $[k,Z]$- multiplier method, we establish the multi-linear estimates, including the bilinear and trilinear estimates on the Bourgain space $X_{s,b}.$ Then, combining the multi-linear estimates with the contraction mapping principle as well as $\widetilde{L}^{2}$ energy method, we establish the global well-posedness and existence of the bounded absorbing sets in $\widetilde{L}^{2}.$ Finally, we show the existence of global attractor in $\widetilde{L}^{2}$ and its compactness in $\widetilde{H}^{5}$ by means of the high-low frequency decomposition method, cut-off function, tail estimate together with Kuratowski α-measure in order to overcome the non-compactness of the classical Sobolev embedding. This result improves earlier ones in the literatures.

专家简介：张再云，博士，湖南理工学院数学学院教授，硕士研究生导师,湖南省高校青年骨干教师，美国《数学评论》特约评论员，美国德克萨斯大学访问学者，省重点学科核心成员，省高校科技创新团队核心成员,主要从事偏微分方程及其应用，包括非线性偏微分方程控制理论、适定性问题，能量分析，低正则问题及其动力学行为，孤波解理论.主持或参与完成国家自科基金、省部级项目多项，获湖南省自然科学奖 1 项。 已在 Proceedings of the American Mathematical Society、Journal of Dynamics & Differential Equations、Journal of Evolution Equations、Nonlinear Anal.TMA、 Math. Meth.Appl. Sci.、 Journal of Mathematical Physics、DCDS-B 等国内外知名数学期刊上发表学术论文 60 余篇，其中 SCI/EI/收录 50 余篇。