International Workshop on the Mathematical Control Theory (数学控制理论国际研讨会)

Conference Program

April 19-April 22, 2018

Sichuan University, Chengdu

Catalog

Basic Information

Invited Speakers:

Baozhu Guo(郭宝珠)	Institute of Systems' Science, CAS
Chaohua Jia(贾超华)	Beihang University
Chanying Li(李婵颖)	Institute of Systems' Science, CAS
Jing Li(李静)	Southwest University of Finance and Economics
Felipe Linares	Instituto de Matemática Pura e Aplicada
Xu Liu(柳絮)	Northeast Normal University
Hongwei Lou(楼红卫)	Fudan University
Qi Lü(吕琦)	Sichuan University
Lionel Rosier	Mines ParisTech
Jean-Claude Saut	Universite Paris XI
Peipei Shang(尚培培)	Tongji University
Zhen Wu(吴臻)	Shandong University
Haisen Zhang(张海森)	Southwest University
Qiong Zhang(张琼)	Beijing Institute of Technology
Shihui Zhu(朱世辉)	Sichuan Normal University

Venue:

Kehuayuan Hotel(科华苑宾馆)
No.141, Kehua North Road, Wuhou District, Chengdu

Organizers:

Xiaoyu Fu(付晓玉) Bing-Yu Zhang(张秉钰)
Xu Zhang(张旭) Zhixiong Zhang(张志雄)
School of Mathematics, Sichuan University

Committee Affairs Group:

Lu Lin(林璐) Yu Zhang(张宇) Zhixiong Zhang(张志雄)

Contact Persons:

Cell Phone：18782999439(Lu Lin), 18202821284(Yu Zhang)
13908221907(Zhixiong Zhang)
E-mail：921867780@qq.com, zxzhang@amss.ac.cn

2018 International Workshop on the Mathematical Control Theory					
Friday (April 20)		Saturday (April 21)		Sunday (April 22)	
08:50–09:40	Hongwei Lou	08:30–09:20	Zhen Wu	08:30–09:20	Qiong Zhang
09:40–10:30	Jean-Claude Saut	09:20–10:10	Lionel Rosier	09:20–10:10	Xu Liu
10:30–10:50	Tea break	10:10–10:40	Photo & Tea break	10:10–10:30	Tea break
10:50–11:40	Shihui Zhu	10:40–11:30	Baozhu Guo	10:30–11:20	Jing Li
11:40–14:00	Lunch	11:30–14:00	Lunch	11:20–14:00	Lunch
14:00–14:50	Peipei Shang	14:00–14:50	Chanyin Li		
14:50–15:40	Haisen Zhang	14:50–15:40	Felipe Linares		
15:40–16:00	Tea break	15:40–16:00	Tea break		
16:00–16:50	Qi Lü	16:00–16:50	Chaohua Jia		
17:30–19:30	Dinner	17:30–19:30	Dinner	17:30–19:30	Dinner

Schedule

April 19

Registration

April 20

Morning

★ 8:30-8:50 Opening Ceremony

Section 1 (Chairman: Jian Zhang)

★ 8:50-9:40
Speaker: Hongwei Lou, Fudan University
Title: Maximizing/Minmizing the principal eigenvalues of multiphase anisotropic conductors

★ 9:40-10:30
Speaker: Jean-Claude Saut, Universite Paris XI
Title: Existence of solitary waves for two-layer systems

★ 10:30-10:50 Tea break

Section 2（Chairman: Zhiqiang Wang）

★ 10:50-11:40
Speaker: Shihui Zhu, Sichuan Normal University
Title: On the Blow-up for the Fractional Nonlinear Schrödinger Equation

★ 11:40-14:00 Lunch

Afternoon

Section 3（Chairman: Bing-Yu Zhang）

★ 14:00-14:50
Speaker: Peipei Shang, Tongji University
Title: Exponential boundary feedback stabilization of a shock steady state for the inviscid Burgers equation

★ 14:50-15:40
Speaker: Haisen Zhang, Southwest University
Title: Second order optimality conditions for optimal control problems of stochastic evolution equations

★ 15:40-16:00 Tea break

Section 4（Chairman: Hongwei Lou）

★ 16:00-16:50

Speaker: Qi Lü, Sichuan University

Title: Well-posedness of Stochastic Riccati Equations and Closed-Loop Solvability for Stochastic Linear Quadratic Control Problems

★ 17:30-20:00 Dinner

April 21

Morning

Section 1（Chairman: Xu Zhang）

★ 8:30-9:20

Speaker: Zhen Wu, Shandong University

Title: Backward Stochastic Differential Equations and Optimal Switching Problem with Two-Time-Scale Markov Chains: Weak Convergence and Stock Trading

★ 9:20-10:10

Speaker: Lionel Rosier, Mines ParisTech

Title: Exact controllability of a linear Korteweg-de Vries equation by the flatness approach

★ 10:10-10:20 Photo

★ 10:20-10:40 Tea break

Section 2（Chairman: Xu Liu）

★ 10:40-11:30

Speaker: Baozhu Guo, Institute of Systems' Science, CAS

Title: Active Disturbance Rejection Control to Uncertain Euler-Bernoulli Beam Equation

★ 11:30-14:00 Lunch

Afternoon

Section 3（Chairman: Zhen Wu）

★ 14:00-14:50

Speaker: Chanying Li, Institute of Systems' Science, CAS

Title: On the STR Problem of nonlinear systems

★ 14:50-15:40

Speaker: Felipe Linares, Instituto de Matemática Pura e Aplicada

Title: Large Data Scattering for Supercritical Generalized KdV

★ 15:40-16:00 Tea break

Section 4（Chairman: Qi Lü）

★ 16:00-16:50

Speaker: Chaohua Jia, Beihang University

Title: Parameter estimation and output feedback stabilization for the linear Kortweg-de Vries equation with disturbed boundary measurement

★ 17:30-20:00 Dinner

April 22

Morning

Section 1（Chairman: Baozhu Guo）

★ 8:30-9:20

Speaker: Qiong Zhang, Beijing Institute of Technology

Title: Stability and Regularity of Solution to the Timoshenko Beam Equation with Local Kelvin-Voigt Damping

★ 9:20-10:10

Speaker: Xu Liu, Northeast Normal University

Title: Carleman estimates for some stochastic parabolic equations of fourth order and application

★ 10:10-10:30 Tea break

Section 2（Chairman: Qiong Zhang）

★ 10:30-11:20

Speaker: Jing Li, Southwest University of Finance and Economics

Title: Well-posedness of Non-homogeneous Boundary Value Problems for the Generalized Burgers Equation on a Finite Interval

★ 11:20-14:00 Lunch

Afternoon

★ 17:30-20:00 Dinner

Titles and Abstracts

Active Disturbance Rejection Control to Uncertain Euler-Bernoulli Beam Equation

Baozhu Guo

Institute of Systems' Science, CAS

Abstract: to appear.

Parameter estimation and output feedback stabilization for the linear Kortweg-de Vries equation with disturbed boundary measurement

Chaohua Jia

Beihang University

Abstract: This paper is concerned with the parameter estimation and boundary feedback stabilization for the linear Korteweg-de Vries equation posed on a finite interval with the boundary observation at the right end and the non-collocated control at the left end. The boundary observation suffers from some unknown disturbance. An adaptive observer is designed and the adaptive laws of the parameters are obtained by the Lyapunov method. The resulted closed-loop system is proved to be well-posed and asymptotically stable in case that the length of the interval is not critical. Moreover, it is shown that the estimated parameter converge to the unknown parameter. As a by-product, a hidden regularity result is proved.

On the STR Problem of nonlinear systems

Chanying Li

Institute of Systems' Science, CAS

Abstract: Adaptive control has achieved a celebrated success in both theory and application due to its toleration of significant uncertainties in plants. So far, the control of linear systems with time-invariant

unknown parameters has been well understood, however, it used to be a difficult topic which took researchers almost two decades to make a breakthrough. Among all the unsolved fundamental problems at that time, the convergence of the least-squares (LS) based self-tuning regulator (STR) is an important one deserving special mention in adaptive control theory. The idea of the STR is owned to R. E. Kalman, but its rigorous analysis was initiated in 1973 by K. J. Åuström, who brought the LS-STR open problem to the attention of the theoretical world of control. It was not until 1995 that this problem was solved completely. Now, our question is if the system is nonlinear, is the STR still effective? This talk is aimed at the identification and control of nonlinear parameterized systems and trying to answer a general STR problem with high degree of nonlinearities in models. Some applications of the STR to aircraft control will be mentioned as well.

Well-posedness of Non-homogeneous Boundary Value Problems for the Generalized Burgers Equation on a Finite Interval

Jing Li

Southwest University of Finance and Economics

Abstract: In this talk, we study the initial-boundary value problem of the generalized Burgers equation posed on a finite interval $(0, L)$ with non-homogeneous boundary conditions. The boundary conditions are given in a general form, which covers the usual Dirichlet, Neumann or Robin boundary conditions. For the generalized Burgers equation, we establish the local well-posedness for the weak solution in $H^s(0, L)$ when the Sobolev index is negative. Besides, for the classical Burgers equation with Dirichlet boundary conditions, we obtain the global well-posedness. (Joint work with Bing-Yu Zhang and Zhixiong Zhang)

Large Data Scattering for Supercritical Generalized KdV

Felipe Linares

Instituto de Matemática Pura e Aplicada

Abstract: We study the long time behavior of solutions to the generalized Korteweg-de Vries equation. Our approach is based on the Kenig-Merle concentration-compactness/rigidity Theory. This is a joint work with L. Farah, A. Pastor and N. Visciglia.

Carleman estimates for some stochastic parabolic equations of fourth order and application

Xu Liu

Northeast Normal University

Abstract: In this talk, some global Carleman estimates for one-dimensional linear forward and backward stochastic parabolic equations of fourth order are established, respectively, by virtue of a duality technique. Compared to the known results, the regularity requirements on some coefficients for the forward equation may be reduced. Meanwhile, the drift term may belong to a Sobolev space of negative order for a backward equation. Based on these estimates, an insensitizing control problem is studied.

Maximizing/Minmizing the principal eigenvalues of multiphase anisotropic conductors

Hongwei Lou

Fudan University

Abstract: The maximization/minimization of the principal eigenvalue of elliptic operators is considered. A relaxed formulation of this problem is considered for composite materials with a volume constraint in the view of control theory. These composites are made from finite number of anisotropic original materials. It is proved that for maximization problems what we considered, the full (unknown) set of admissible composite designs could just be reduced to the arithmetic mean of original ones. While for minimization problems, the optimal composite designs could be reduced to the harmonic mean of original ones. (Joint work with Xueyuan Yin)

Well-posedness of Stochastic Riccati Equations and Closed-Loop Solvability for Stochastic Linear Quadratic Control Problems

Qi Lü

Sichuan University

Abstract: We study the closed-loop solvability of a stochastic linear quadratic optimal control problem for systems governed by stochastic evolution equations. This solvability is established by means of solvability of the corresponding Riccati equation, which is implied by the uniform convexity of the quadratic cost functional. At last, conditions ensuring the uniform convexity of the cost functional are discussed.

Exact controllability of a linear Korteweg-de Vries equation by the flatness approach

Lionel Rosier

Mines ParisTech

Abstract: We consider a linear Korteweg-de Vries equation on a bounded domain with a left Dirichlet boundary control. The controllability to the trajectories of such a system was proved in the last decade by using some Carleman estimate. Here, we go a step further by establishing the exact controllability in a space of analytic functions with the aid of the flatness approach. A crucial step is a smoothing effect for the free evolution of KdV from L2 to the class of Gevrey functions of order 1/2. This is a joint work with P. Martin, I. Rivas and P. Rouchon.

Existence of solitary waves for two-layer systems

Jean-Claude Saut

Universite Paris XI

Abstract: We study the existence and properties of solitary wave solutions for two classes of two-layer systems modeling the propagation of internal waves. More precisely we consider the Boussineq-Full dispersion system and the Intermediate Long Wave (ILW) system together with its Benjamin -Ono limit. This is a joint work with Jaime Angulo.

Exponential boundary feedback stabilization of a shock steady state for the inviscid Burgers equation

Peipei Shang

Tongji University

Abstract: We study the exponential stabilization of a shock steady state for the inviscid Burgers equation on a bounded interval. Our analysis relies on the construction of an explicit strict control Lyapunov function. We prove that by appropriately choosing the feedback boundary conditions, we can stabilize the state as well as the shock location to the desired steady state in H2-norm, with an arbitrary decay rate.

Backward Stochastic Differential Equations and Optimal Switching Problem with Two-Time-Scale Markov Chains: Weak Convergence and Stock Trading

Zhen Wu

Shandong University

Abstract: This talk is concerned with backward stochastic differential equations (BSDEs) and optimal switching problem coupled by a continuous-time finite-state Markov chain which has a two-time-scale structure, i.e., the states of the Markov chain can be divided into a number of groups such that the chain jumps rapidly within a group and slowly between the groups. In this talk, we give some convergence results as the fast jump rate goes to infinity, which can be used to reduce the complexity of the original problem. This method is also referred to as singular perturbation. The first result is the weak convergence of the BSDEs with two-time-scale Markov chains. It is shown that the solution of the original BSDE system converges weakly under the Meyer-Zheng topology to that of an aggregated BSDE system. Then we focus on the optimal switching problem for regime switching model with two-time-scale Markov chains. We obtain the optimal switching strategy by virtue of dynamic programming principle and prove the convergence of the value function under the two-time-scale structure. Finally, as an application of the theoretical results, an example concerning the stock trading problem in a regime switching market is provided. Both the optimal trading rule and convergence result are numerically demonstrated in this example.

Second order optimality conditions for optimal control problems of stochastic evolution equations

Haisen Zhang

Southwest University

Abstract: In this talk, we will present our recent work on second order necessary and sufficient optimality conditions for optimal control problems of stochastic evolution equations. The control acts both in the drift and diffusion terms of the control system and the control region is convex. The concepts of relaxed and V-transposition solution of backward stochastic evolution equations are used to derive those optimality conditions. The correction part of the second order adjoint equation, which dose not appear in the first order optimality conditions, plays a fundamental role in the second order optimality conditions. (This is a joint work with Professor Xu Zhang and Qi Lü.)

Stability and Regularity of Solution to the Timoshenko Beam Equation with Local Kelvin-Voigt Damping

Qiong Zhang

Beijing Institute of Technology

Abstract: We consider the Timoshenko beam equation with locally distributed Kelvin-Voigt damping, i.e., the damping is effective only in a part of the spatial domain for both shear stress and bending moment. We prove eventual differentiability, exponential and polynomial stability of the associated semigroup under some smoothness condition on the damping coefficient functions, particularly, at the interface of the damped and undamped region.

On the Blow-up for the Fractional Nonlinear Schrödinger Equation

Shihui Zhu

Sichuan Normal University

Abstract: In this talk, we consider the dynamical properties of solutions to the fractional nonlinear Schrodinger equation (FNLS, for short) arising from pseudorelativistic Boson stars, of the form

$$iu_t - (-\triangle)^s u + (\frac{1}{|x|^\gamma} * |u|^2)u = 0, \qquad (FNLS)$$

where i is the imaginary unit and $\psi = \psi(t,x)$: $\mathbb{R} \times \mathbb{R}^N \to \mathbb{C}$. The fractional differential operator $(-\triangle)^s$ is defined by $(-\triangle)^s\psi = \mathcal{F}^{-1}[|\xi|^{2s}\mathcal{F}[u]]$, where $\mathcal{F}$ and $\mathcal{F}^{-1}$ are the Fourier transform and inverse Fourier transform, respectively. The parameter $0 < s < 1$ is the corresponding index of the Lévy stable processes(see[Laskin2000,Laskin2002]).

First, by establishing the profile decomposition of bounded sequences in H^s, we find the best constant of a Gagliardo-Nirenberg type inequality. Secondly, we obtain the stability($0 < \gamma < 2s$) and instability($\gamma = 2s$)of standing waves for (FNLS) by the profile decomposition. Thirdly, we investigate the dynamical properties of blow-up solutions for (FNLS) with $\gamma = 2s$, including sharp threshold mass, concentration and limiting profile. Finally, we find the sharp threshold of blow-up and scattering for (FNLS) with $\gamma > 2s$.

This work is joint with Jian Zhang(University of Electronic Science and Technology of China), and Qing Guo(Minzu University of China).

List of Participants

Li Deng	Southwest Jiaotong University	dengli@amss.ac.cn
Xiaoyu Fu	Sichuan University	xiaoyufu@scu.edu.cn
Xiaoqi Geng	Sichuan University	
Baozhu Guo	Institute of Systems' Science, CAS	bzguo@iss.ac.cn
Chaohua Jia	Beihang University	jiach@amss.ac.cn
Chanying Li	Institute of Systems' Science, CAS	cyli@amss.ac.cn
Dan Li	Chongqing University	liwadanj@126.com
Hongheng Li	Leshan Normal University	
Jing Li	Southwest University of Finance and Economics	jingli@swufe.edu.cn
Dongdong Liang	Sichuan University	
Lu Lin	Sichuan University	linlu_67@163.com
Felipe Linares	Instituto de Matemática Pura e Aplicada	linares@impa.br
Xu Liu	Northeast Normal University	liux216@nenu.edu.cn
Hongwei Lou	Fudan University	hwlou@fudan.edu.cn
Shu Luan	Lingnan Normal University	luanshu@yeah.net
Haimeng Luo	Sichuan University	
Qi Lü	Sichuan University	lu@scu.edu.cn
Lionel Rosier	Mines ParisTech	lionel.rosier@mines-paristech.fr
Jean-Claude Saut	Universite Paris XI	jean-claude.saut@u-psud.fr
Peipei Shang	Tongji University	peipeiShang@hotmail.com
Chengqiang Wang	Chengdu Normal University	chengqiangwang2017@163.com
Yanqing Wang	Southwest University	yqwang@amss.ac.cn
Zhiqiang Wang	Fudan University	wzq@fudan.edu.cn
Zhen Wu	Shandong University	wuzhen@sdu.edu.cn
Zhongqi Yin	Sichuan Normal University	zhongqiyin@sohu.com
Bing-Yu Zhang	University of Cincinnati	zhangb@ucmail.uc.edu
Detao Zhang	Shandong University	zhangdetao@sdu.edu.cn
Haisen Zhang	Southwest University	haisenzhang@yeah.net
Hualei Zhang	Sichuan University	1143031787@qq.com
Jian Zhang	University of Electronic Science and Technology	zhangjiancdv@sina.com

Qiong Zhang	Beijing Institute of Technology	zhangqiong@bit.edu.cn
Xu Zhang	Sichuan University	zhang_xu@scu.edu.cn
Yu Zhang	Sichuan University	921867780@qq.com
Zhixiong Zhang	Sichuan University	zxzhang@amss.ac.cn
Xiangqing Zhao	Zhejiang Ocean University	zhao-xiangqing@163.com
Chuang Zheng	Beijing Normal University	chuang.zheng@bnu.edu.cn
Zhongcheng Zhou	Southwest University	zhouzc@amss.ac.cn
Shihui Zhu	Sichuan Normal University	shihuizhumath@163.com
Xianzheng Zhu	Sichuan University	