数学及其应用联合学术研讨会

(Joint Workshop on Mathematics and Applications)

武汉大学数学与统计学院

(School of Mathematics and Statistics, Wuhan University)

二零一八年六月十一至十三日

(11th--13th June, 2018)

Program of the Workshop

时间		活动内容		地点
6 月 11 日		会议报到		君宜王朝大饭店
6 月 12 日	9:00–9:30	杨彤: Solutions to the spatially inhomogeneous non-cutoff Kac equation	主持人: 赵会江	武汉大学理学院东北楼 4 楼 404
	9:30–10:00	代 丹: Tracy-Widom distributions in critical unitary random matrix ensembles and the coupled Painleve II system		
	10:00–10:30	向伟: Uniqueness for shock reflection problem		
	10:30–10:45	茶歇		
	10:45–11:15	韓耀宗: Meshless computational methods for solving non-local problems chemotaxis-haptotaxis model	主持人: 李维喜	
	11:15–11:45	张强: Anomalous Phenomena for Objects Embedded in Inelastic Particle Systems		
	12:00–13:30	午餐		田园小观园
	14:30–17:30	学生见面会 1、介绍香港城市大学研究生招生情况; 2、香港城市大学的老师们介绍各自的研究方向; 3、与会的本科生和研究生简要介绍各自的情况; 4、分组自由交流		武汉大学理学院东北楼 4 楼 404
	18:00–19:30	晚餐		田园小观园
6 月 13 日	9:30–10:00	自由讨论	主持人: 赵会江	武汉大学理学院东北楼 4 楼 404
	12:00–13:30	午餐		田园小观园

Abstracts

Tracy-Widom distributions in critical unitary random matrix ensembles and the coupled Painleve II system

Dan Dai (代丹)

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We study Fredholm determinants of the Painleve II and Painleve XXXIV kernels. In certain critical unitary random matrix ensembles, these determinants describe special gap probabilities of eigenvalues. We obtain Tracy-Widom formulas for the Fredholm determinants, which are explicitly given in terms of integrals involving a family of distinguished solutions to the coupled Painleve II system in dimension four. Moreover, the large gap asymptotics for these Fredholm determinants are derived, where the constant terms are given explicitly in terms of the Riemann zeta-function.

Meshless computational methods for solving non-local problems

Benny Y. C. HON (韓耀宗)

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In this talk, the recent development in global, local, and integration-based meshless computational methods via the use of radial basis functions (RBFs) will be presented. In particular, the local radial basis function collocation method (LRBFCM) is an extension to solve large scale problems which has hindered the practical application of the global RBFs method for years due to the ill-conditioning of the resultant full coefficient matrix. The LRBFCM has recently been applied to solve cavity flows problems with free surface and some non-local (diffusion, phase-field, nonlinear Schrodinger, peridynamic) problems. In addition to the meshless and spectral convergence advantages of RBF methods, the integration-based RBF method enjoys the unconditional stability of numerical integration over differentiation and hence is perfect to solve various kinds of stiff problems. Numerical examples in higher dimensions will be given to verify the efficiency and effectiveness of the proposed methods.

Uniqueness for shock reflection problem

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We discuss the uniqueness of shock reflection problem governed by the potential flow equation in a natural class of self-similar solutions. The approach is based on a version of method of continuity. A property of solutions important for the proof of uniqueness is the convexity of the free boundary. So we will also discuss our recent result on the convexity. This talk is based on joint work with G.-Q. Chen and Mikhail Feldman.

Solutions to the spatially inhomogeneous non-cutoff Kac equation

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Consider the one dimensional inhomogeneous non-cutoff Kac equation, based on the analysis on the linearized operator obtained by Lerner-Morimoto-Pravda-Starov-Xu, we first show the existence of global solution to the equation around a global Maxwellian by combining two sets of macro-micro decomposition. Then by using the dissipative norm of the linearized operator in the fractional Hermite-Sobolev space and by using the perturbation theory, the spectrum structure of the linearized Kac equation will be given. Then the optimal time decay estimate for the nonlinear Kac equation is then obtained. This is a joint work with Hongjun Yu.

Anomalous Phenomena for Objects Embedded in Inelastic Particle Systems

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It is well known that granular particles can exhibit behavior similar to that of fluids. We show that a very surprising phenomenon can occur when objects were embedded in granular particles. Such a phenomenon will not be possible to occur when objects are embedded in fluids. When an object embedded in a liquid or a gas, it experiences bombardment by fast-moving atoms or molecules. This leads to random motion of the embedded object known as Brownian motion. For fluid systems, the average net force exerted on the embedded object is zero. This property is independent of the shape of the embedded body. We show surprisingly that, even in the absence of external forces, the average net force exerted on the embedded object by the inelastic granular particles can be non-zero. We explain why such a surprising phenomena only exists in the granular particle systems, but not in fluid systems.