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Workshop on Analysis and Probability

24 September 2022 (Saturday)
Room 222, Lady Shaw Building

Time	Talk by Speaker (list of abstracts on next page)
10:00 – 11:00	**Continuous Piecewise Linear Iterated Function Systems on the Line** by *Professor Karoly Simon* *Budapest University of Technology and Economics*
11:15 – 12:15	**Large Deviations and Convergence Rate in the Gaussian Approximation for Products of Random Matrices** by *Professor Quansheng Liu* *Université Bretagne Sud*
14:00 – 15:00	**On the Existence of Cut Points of Connected Generalized Sierpinski Carpets** by *Dr. Jian-Ci Xiao* *The Chinese University of Hong Kong*
15:30 – 16:30	**Hydrodynamic Limits and Fluctuation Limits for Reflected Diffusions with Annihilations on a Membrane** by *Professor Wai Tong Fan* *Indiana University*

All Are Welcome!

Titles and Abstracts

Continuous Piecewise Linear Iterated Function Systems on the Line

Károly Simon
Budapest University of Technology and Economics & CUHK

Abstract: We study the dimension theory of Continuous Piecewise Linear Iterated Function Systems (CPLIFS) on the line. A CPLIFS $\mathcal{F}$ consists of finitely many continuous contracting self mappings $\{f_1, \dots, f_m\}$ of $\mathbf{R}$ such that for all $i = 1, \dots, m$ the mapping f_i is strictly contractive, piecewise linear and all of its slopes are different from zero. However, we do not assume that these maps are injective. Our goal is to compute the dimension (Hausdorff and box) of the attractor Λ of the CPLIFS $\mathcal{F}$. The new results of the talk are joint with Dániel Prokaj (Budapest) and Peter Raith (Vienna).

Large Deviations and Convergence Rate in the Gaussian Approximation for Products of Random Matrices

Quansheng LIU
Université Bretagne Sud

Abstract: In this talk I will present some recent progress on large deviations and convergence rate in the centra limit theorem for products of independent and identically distributed random matrices. Applications to multi-type branching processes in random environments and branching random walks will also be explained.

References

[1] Hui Xiao, Ion Grama, Quansheng Liu. Berry-Esseen bound and precise moderate deviations for products of random matrices. *Journal of the European Mathematical Society*, 24 (2022), 2691–2750.

[2] H. Xiao, I. Grama, Q. Liu. Precise large deviation asymptotics for products of random matrices. *Stochastic Processes and their Applications* 130 (2020), no.9, 5213-5242.

[3] Ion Grama, Quansheng Liu and Erwan Pin. A Kesten-Stigum type theorem for a super-critical multi-type branching process in a random environment. *Annals of Appled Probability,* to appear, 52 pages; online: hal-02878026.

[4] Thi Thuy Bui, Ion Grama, Quansheng Liu. Central limit theorem and precise large deviations for branching random walks driven by products of random matrices. hal-02911860

On the Existence of Cut Points of Connected Generalized Sierpinski Carpets

Jian-Ci Xiao
The Chinese University of Hong Kong

Abstract: I will introduce a characterization of the existence of cut points of connected generalized Sierpinski carpets. The criterion is based on examining a finite number of elements in the corresponding Hata graph sequence. Some examples, including connected carpets with exactly m cut points, will be presented in addition. This includes some joint works with Xin-Rong Dai, Jun Luo, Huo-Jun Ruan and Yang Wang.

Hydrodynamic Limits and Fluctuation Limits for Reflected Diffusions with Annihilations on a Membrane

Wai Tong Fan
Indiana University

Abstract: Mathematicians and scientists use interacting particle models to gain understanding of the emergence of macroscopic phenomena from microscopic laws of nature. In this talk, I will introduce a class of interacting particle systems that can model the transport of positive and negative charges in solar cells. To connect the microscopic mechanisms with the macroscopic behaviors at two different scales of observations, we prove the hydrodynamic limits and the fluctuation limits for these systems. Proving these two types of limits represents establishing the law of large numbers and the central limit theorem, respectively, for the time-trajectory of the particle densities. We show that the hydrodynamic limit is a pair of deterministic measures whose densities solve a coupled nonlinear heat equations, while the fluctuation limit can be described by a Gaussian Markov process that solves a stochastic partial differential equation. This is joint work with Zhen-Qing Chen.