



吉林大学
JILIN UNIVERSITY

数学学院



National Academy of Sciences of Ukraine
INSTITUTE OF MATHEMATICS

International
Online mini school
for students and young researchers
Modern problems
in
Stochastic Processes

November 25 – 29,
2024



Welcome to the "Modern Problems in Stochastic Processes" School!

The primary goal of the online mini-school is to illuminate the modern problems encountered in various branches of stochastic processes theory. Through a series of comprehensive lectures, we aim to explore contemporary research and applications within this field. The lectures are suitable for undergraduate students, master's students, young researchers, and everyone interested in this field.

The online mini-school provides an excellent platform for creating connections and strengthening international collaborations.

The mini-school's online format will allow participants to join remotely from anywhere in the world, providing convenient access to high-quality lectures.

Link for zoom meeting:

<https://us06web.zoom.us/j/82001504934?pwd=39wyumveeXzWPCI92JpinidT7tuH5o.1>

meeting ID: 820 0150 4934

password: 748893

All lectures will be recorded and will be available on the YouTube channel <https://www.youtube.com/@theoryofstochasticprocesses>

Organization committee

Prof. Dorogovtsev Andrey A., Department of Theory of Random Processes, Institute of Mathematics, National Academy of Science of Ukraine

Prof. Yuecai Han, Department of Probability Statistics and Data Science, School of Mathematics, Jilin University, China.

Prof. Xia Chen, Department of Mathematics, University of Tennessee, Knoxville

Ph.D. Hlyniana Kateryna School of Mathematics, Jilin University, (China), Institute of Mathematics, National Academy of Science of Ukraine.

Sponsors: Jilin University, School of Mathematics.

List of lectures

- **Andrey A. Dorogovtsev**

National Academy of Science of Ukraine, Institute of Mathematics

“Mathematical models of linear polymers”

- **Georgii Riabov**

National Academy of Science of Ukraine, Institute of Mathematics

“Gaussian measures”

- **Kateryna Kustarova**

National Academy of Science of Ukraine, Institute of Mathematics

“Probabilistic aspects of machine learning”

- **Kateryna Hlyniana**

School of Mathematics, Jilin University, (China)

National Academy of Science of Ukraine, Institute of Mathematics

“Point processes for systems of particles with interactions”

Schedule

Online lectures

Date	Lecture	Beijing time	Kyiv time
Monday, November 25	A.A. Dorogovtsev, Lecture 1	15:00-16:00	9:00-10:00
	K. Kustarova, Lecture 1	16:15-17:15	10:15-11:15
Tuesday, November 26	A.A. Dorogovtsev, Lecture 2	15:00-16:00	9:00-10:00
	K. Hlyniana, Lecture 1	16:15-17:15	10:15-11:15
Wednesday, November 27	G. Riabov, Lecture 1	15:00-16:00	9:00-10:00
	K. Kustarova, Lecture 2	16:15-17:15	10:15-11:15
	K. Hlyniana, Lecture 2	17:30-18:30	11:30-12:30
Thursday, November 28	G. Riabov, 2	15:00-16:00	9:00-10:00
	K. Hlyniana, 3	16:15-17:15	10:15-11:15
Friday, November 29	A.A. Dorogovtsev, Lecture 3	15:00-16:00	9:00-10:00
	G. Riabov, Lecture 3	16:15-17:15	10:15-11:15
	K. Kustarova, Lecture 3	17:30-18:30	11:30-12:30

Lectures

Dorogovtsev Andrey A.



Professor Andrey Dorogovtsev is a corresponding member of the National Academy of Sciences of Ukraine, the head of the Department of Theory of Random Processes of the Institute of Mathematics of the National Academy of Sciences of Ukraine, mainly engaged in the research of probability theory and related fields. Under his supervision, 15 students defended their Ph.D. theses, and 4 received a habilitation degree.

His research interests cover different areas such as probability theory, stochastic processes, Malliavin calculus, stochastic differential equations, random operators, measure-valued processes, and stochastic flows. He has teaching experience in different universities in Ukraine and outside the country. He was invited many times as a visiting professor to universities in the USA, China, Netherlands, Tunisia, Turkey, Spain, and the UK. In 2003, he received the State Prize in Science and Technology from the Ukraine. Professor Andrey Dorogovtsev is a member of the editorial board of the Theory of Stochastic Processes, Ukraine Mathematical Journal, and the Journal of Stochastic Analysis.

Professor Andrey Dorogovtsev will give a mini-course devoted to Mathematical models of linear polymers.

Lecture course: Mathematical models of linear polymers

Lecture 1. Properties of linear polymers. (Independence, Flory index, excluding volume effect. Brownian trajectories as free polymers. Self-intersections, Evans measure. Large deviations).

Lecture 2. Non-Markovian processes as polymer models. (Integrators. Renormalizations of self-intersection local times. Asymptotic of gyration radius, large deviations.)

Lecture 3. Models for polymer dynamics. (Self-crossing and folding effects. Image of the smooth curve under Gaussian random field. Changing of the topological type. Characteristics of complexity. Flow of Brownian motions and Markov semi-groups. Folding of the random curves)

Georgii Riabov



The lecturer is a Senior researcher at the Department of the Theory of Stochastic Processes, Institute of Mathematics, National Academy of Science of Ukraine, with a Ph.D. degree. His primary area of research lies in stochastic analysis, specifically focusing on topics such as Gaussian measures, measures on infinite-dimensional spaces, and infinite-dimensional analysis.

He is published in various international journals and actively participates in international conferences. His research has garnered recognition, including the Supreme Council of Ukraine Award for talented fundamental and applied research scientists in 2018.

Georgii Riabov will give a mini-course devoted to Gaussian measures.

Lecture course: Gaussian measures

Lecture 1. Generalized Wiener functionals and capacities.

We will discuss the notion of capacity on a Wiener space introduced by P. Malliavin, and see the important properties that hold a.s. for the Wiener measure and are also true for measures that are singular with respect to the Wiener measure, but concentrated on sets of positive capacity.

Lecture 2. Finite absolute continuity of measures.

We will define the notion of finite absolute continuity of measures. Using this notion, we will define analogues of the Ito-Wiener decomposition for non-Gaussian product-measures, mixtures of non-Gaussian measures, and affine transformations in a Gaussian setting.

Lecture 3. Finite absolute continuity with respect to Gaussian measures.

We will introduce the notion of the shift along the basis in the Cameron-Martin space of a Gaussian measure. Using this notion together with the notion of p -summable operators we will prove several properties of measures that are finitely absolutely continuous with respect to the initial Gaussian measure.

Kateryna Kustarova



Kateryna is a Ph.D. student in the Department of Random Processes at the Institute of Mathematics and a participant in various conferences. She did a Master's thesis at Igor Sikorsky Kyiv Polytechnic Institute in Applied Mathematics, with a concentration in cryptography and mathematical methods for information security. She holds a senior machine learning position at a medical company. Kateryna has experience in developing predictive models for financial time series using neural networks and classical machine learning algorithms (Exos Financial, USA, NY), implementing machine learning solutions for large-scale business problems (Shift.com, USA, CA), and big data analytics (EVO, Ukraine, Kyiv). She is a certified Python programmer specializing in machine learning and big data processing (PyTorch, TensorFlow, Hadoop).

She will deliver lectures on the introduction and core concepts of machine learning, discuss the most rapidly developing areas, and explain the distinctions between AI, ML, DS, DL, and BD. Additionally, she will cover the probabilistic aspect of supervised learning and demonstrate practical applications.

Lecture course: “Probabilistic aspects of machine learning”

Lecture 1. From training data to predictions: core concepts in supervised learning

Lecture 2. Empirical risk minimization and the statistical learning framework

Lecture 3. Linear least-squares regression: theory, applications, and analysis

Kateryna Hlyniana



Kateryna is a doctor of philosophy(PhD) in mathematics and was a fellow researcher at the Department of the Theory of Stochastic Processes in the Institute of Mathematics. National Academy of Science of Ukraine. Now, she is in a Postdoctoral position at the School of Mathematics at Jilin University. Her current scientific interests are stochastic flows with interactions, random measures, and point processes. She has experience in teaching as a lecturer in Probability, Stochastic Processes, and Discrete Mathematics. She got grants and awards such as the National Academy of Sciences Grant for Young Scientists (2017), the Supreme Council of Ukraine Award for Talented Fundamental and Applied Research Scientists (2018), a Grant from the National Natural Science Foundation of China (2022), and the “Outstanding Foreign expert of Jilin Province” (2023, China). She has publications in international scientific journals and numerous talks on conferences.

She will give a mini-course devoted to the application of point processes in describing systems of particles with interaction.

Lecture course: “Point processes for systems of particles with interactions”

Lecture 1. Basic properties and tools of investigation of point processes.

Lecture 2. Permanental and Determinantal point processes as models of systems of bosons and fermions.

Lecture 3. Systems with coalescing and Pfaffian point processes.