LABORATORY 16

Laboratory of Stochastic Dynamical Systems

Head of Laboratory – Dr.Sc. (Mathematics), Prof. Aleksandr Veretennikov
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The leading researchers of the laboratory include:

Dr.Sc. (Techn.)	R. Liptser	Dr.	P. Kitsul
Dr.	F. Grigoriev	Dr.	A. Puhalskii
Dr.	O. Gulinsky	Dr.	A. Serebrovskii
Dr.	V. Kistlerov	Dr.	S. Lototsky

Currently R. Liptser, P. Kitsul, A. Puhalskii and S. Lototsky are working abroad remaining the staff members of Laboratory.

MAIN RESULTS

The main direction of activity in 2002 was stochastic analysis and its applications. The important results in this area have been obtained during last years in laboratory. The series of Puhalskii's publications received recognition as 2002 INFORMS Applied Probability Society Best Publications:

– Polling Systems in Heavy Traffic: A Bessel Process Limit // Mathematics of Operations Research. 1998. V. 23. No. 2. P. 257-304 (with E.G. Coffman, Jr., and M.I. Reiman).

– Polling Systems with Zero Switchover Times: a Heavy-Traffic Averaging Principle. // The Annals of Applied Probability. 1995. V. 5. No. 3. P. 681-719 (with E.G. Coffman, Jr., and M.I. Reiman).

Special attention was given to studying non-standard problems of the large deviation theory.

A. Puhalskii obtained new results on the connection between large deviation principles for trajectories of stochastic processes and the associated invariant measures. The large deviation accumulation point of a sequence of invariant measures is identified as invariant measure of the limit idempotent processes. Application to diffusion and queueing processes are provided.

– Puhalskii A. On large deviation convergence of invariant measures // J. Theoret. Prob. (to appear).

O. Gulinsky proposed an approach to large deviation for asymptotic problems without evident probabilistic representation behind. The motivation of this method is coming from some problems of quantum mechanics. These tools make it possible to handle non-commutative asymptotic problems as one would handle classical large deviations. The approach is applied to an example of non-commutative large deviations which is based on an analysis of mean-field quantum crystal model.

– Gulinsky O. The Principle of the Largest Terms and Quantum Large Deviations // Kybernetika. 2003. V. 38. No. 2 (in print).

R. Liptser and A. Veretennikov studied moderate deviations for smooth processes.

Large deviation results for stochastic differential equations driven by Brownian motions are known. However in some problems of mathematical physics it is more natural to consider equations with smooth random perturbations. A large deviation principle are established for a family of vector-valued smooth random processes defined by a system of ordinary differential equations with perturbations defined by smooth vector function of vector-valued ergodic diffusion.

– Liptser R., Veretennikov A. Freidlin-Wentzell type moderate deviations for smooth processes // Markov Processes and Related Fields (to appear).

Large deviations for approximations of stochastic differential equation is a new direction of activity.

A. Veretennikov proved the large deviation principle for Euler approximation of SDE.

– Veretennikov A. On large deviations for approximations of SDEs // Probability Theory and Related Fields (to appear).

– Veretennikov A. On large deviations for approximations of SDEs on the torus // Theory of Probability and their Applications – TViP (to appear).

A. Veretennikov continued studying diffusion approximation of Poisson processes.

– Veretennikov A., Pardoux E. On Poisson equation and diffusion approximation 2 // Annals of Probability (to appear).

Some new results are obtained on parameter estimation for ergodic Marcov chains with polynomial growth lost function.

– Veretennikov A., Varakin A. On parameter estimation for polynomial ergodic Markov chains with polynomial growth lost function // Markov Processes and Related Fields. 2002. No. 8(1). P. 127-144.

P. I. Kitsul, R. Sh. Liptser, A.P.Serebrovski studied properties of observable components of a Markov process. Necessary and sufficient conditions of markovianity are obtained.

– Kitsul P.I., Liptser R.Sh., Serebrovski A.P. Markovianity of a subset of components of a Markov process // J. Systems & Control Letters. 2002. V. 46/4. P. 237-242.

Teaching:

– Moscow Institute of Physics and Technology: O.Gulinsky, A.Serebrovskii and F. Grigoriev;

– Universities abroad: A.Veretennikov, R. Liptser, A. Puhalskii, P. Kitsul, S. Lototski.

International collaboration. Fruitful collaboration is established with the probability group of the LATP CMI Universite de Provence, Marseille, France, and, in particular, with Professor Etienne Pardoux as its leader.

We also have close contacts with Universite Paris 6 (Professors Jean Jacod and Pierre Priouret); Universite du Main in France (Professor Yuri Kutoyants); Weierstrass Institute for Applied Analysis and Stochastics – WIAS, Berlin, Germany; the Univerity of Warwick, UK (Professor David Elworthy); Mathematical Institute of the University of Copenhagen; University of Trier (Professor Dieter Baum); University of Wuerzburg (Professor Elart von Collani), and some others.

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