TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV

INTERNATIONAL CONFERENCE

PROBABILITY, RELIABILITY AND STOCHASTIC OPTIMIZATION

APRIL 7–10, 2015, KYIV, UKRAINE

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RANDOM EVOLUTION WITH CONTROL AND MARKOV SWITCHING

Ya. M. Chabanyuk

Asymptotic behaviour of random evolutions with Markov switching in averaging, diffusion approximation, Poisson approximation and Levy approximation schemes was considered in [1]. In [2] results for such behaviour were obtained for procedure of stochastic approximation (SAP) and optimization (SOP) as controlled Markov process.

In this work SAP with Markov switching in diffusion approximation scheme and impulse perturbation with independent increments was considered. Suffisient conditions of convergence of random evolution with control in asymptotically small diffusion scheme were obtained.

Results for SOP for the project size index "s" the prediction of the software reability when testing for errors with the function of the intensity error detection [3].

$$\lambda\left(s,t\right) = \hat{\alpha}\hat{\beta}^{s+1}t^{s}\exp\left(-\hat{\beta}t\right),$$

where $\hat{\alpha}$ and $\hat{\beta}$ obtain by maximum likelihood method.

References

[1] Korolyuk, V. S., Limnios, N. Stochastic Systems in Merging Phase Space. World Scientific Publishing, 2005.

[2] Khasminskii, R. Z. Stability of Systems of Differential Equations with Random Perturbations of Their Parameters. Nauka, Moscow, 1969.

[3] Fedasyuk, D. V., Seniv, M. M., Chabanyuk, Ya. M., Khimka, U. T. *The model of estimation and prediction of the software reability with the project size index.* Proceedings of the X-th International Confrence "Modern Problems of Radio Engineering, Telecommunications, and Computer Science", Lviv–Slavske, Ukraine, 2010, 209–210.

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RECENT DEVELOPMENTS IN RANDOM AFFINE RECURSIONS

E. Damek

We consider the following affine recursion in $\mathbb{R}^d$

$$X_n = A_n X_{n-1} + B_n, \quad n \geq 1 \tag{1}$$

where (A_n, B_n) is a sequence of i.i.d. (independent identically distributed) random variables with values in $GL(\mathbb{R}^d)\times\mathbb{R}^d$ and $X_0 \in \mathbb{R}^d$ is the initial distribution. The generic element of the sequence (A_n, B_n) will be denoted by (A, B). Under mild contractivity hypotheses the sequence X_n converges in law to a random variable R, which is the unique solution of the stochastic difference equation

$$R =_d AR + B, \qquad \text{where } R \text{ is independent of } \ (A, B) \tag{2}$$

and equality is meant in law. The main issues concerning (1) are characterization of the tail of R, regularity of the law of R, behavior of iterations X_n.

First results were obtained already in seventies by Kesten for matrices with positive entries and by Grincevicius and Vervaat in the one dimensional case. However recently, due to its importance, equation (2) has again attracted attention of many people the contribution of the Wrocław team being essential.

With so called Kesten assumptions R has a heavy tail behavior which, means that there is $\alpha > 0$ such that $\lim_{t\to\infty}\mathbb{P}\{\|R\| > t\}t^{\alpha} = C_{\infty} > 0$. However, there is still no satisfactory description of the constant C_{∞} as well as the rate of convergence of $\mathbb{P}\{\|R\| > t\}t^{\alpha}$ to C_{∞}. *I am going to talk about the latter problem both in the case of recursion* (1) *and the Lipschitz iterative systems modeled on it.* Good formulae for C_{∞} are important from the point of view of applications.

The talk is based on the joint work with Dariusz Buraczewski, Jacek Zienkiewicz – Wrocław University, Rafał Latała, Piotr Nayar – Warsaw University and Tomasz Tkocz – University of Warwick.

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The author is supported by NCN Grant UMO-2011/01/M/ST1/04604.

L_2-RATES OF APPROXIMATION OF NONSMOOTH INTEGRAL-TYPE FUNCTIONALS

Iu. V. Ganychenko

We consider an $\mathbb{R}^d$-valued Markov process $X_t, t \geq 0$ and establish strong L_2-rates of approximation of integral-type functional I_T of such a process by integral sums $I_{T,n}$, where

$$I_T(h) = \int_0^T h(X_t)\,dt, \ I_{T,n}(h) = \frac{T}{n}\sum_{k=0}^{n-1} h(X_{(kT)/n}), \quad n \geq 1.$$