

NEW DOCTORAL DEGREES
IN THE DEPARTMENT OF MATHEMATICS
UNIVERSITY OF OSIJEK

Dr. Nenad Šuvak received his PhD in Mathematics from the Department of Mathematics of the University of Zagreb on 29 April 2010 with the dissertation entitled “STATISTICAL ANALYSIS OF PEARSON DIFFUSIONS WITH HEAVY-TAILED MARGINAL DISTRIBUTIONS” (Mentors: Prof. M. Benšić, Prof. N. N. Leonenko and Prof. M. Huzak).

Abstract

This PhD thesis presents some new results on spectral properties and statistical analysis of ergodic diffusions with heavy-tailed stationary distributions from the Pearson family. In particular, Fisher-Snedecor, reciprocal gamma and Student diffusion processes are treated. For these three diffusions the spectral representation of the transition density is derived and problems of parameter estimation and testing statistical hypothesis about the stationary distribution are considered.

Unknown parameters of the stationary distribution of the particular heavy-tailed Pearson diffusion are estimated by the method of moments. This method here provides consistent and asymptotically normal estimators given in the explicit form. Moreover, for all observed cases asymptotic covariance matrices are explicitly calculated. Expressions for elements of the asymptotic covariance matrices are determined by using the closed-form expressions for the spectral representations of the transition densities and the new method for calculation of moments of the form $E[X_{s+t}^m X_s^n]$ which is based on the orthogonality of solutions of the corresponding Sturm-Liouville equation.

The consistent estimator of the autocorrelation parameter is derived by the generalized method of moments (GMM) based on the Pearson's sample correlation function.

Statistical test for assumptions about the stationary distribution of the particular heavy-tailed Pearson diffusion is constructed by the GMM approach and relies on the moment condition based on the orthogonality property of the corresponding polynomial eigenfunctions: Fisher-Snedecor polynomials related to Fisher-Snedecor diffusion, Bessel polynomials related to reciprocal gamma diffusion and Routh-Romanovski polynomials related to Student diffusion. It is proved that the constructed test statistics has the χ^2 distribution with the number of degrees of freedom coinciding with the number of orthogonal polynomials used in the underlying moment condition.

Published papers

- [1] N. N. Leonenko, **N. Šuvak**, *Statistical inference for Student diffusion process*, Stoch. Anal. Appl., accepted for publication.
- [2] N. N. Leonenko, **N. Šuvak**, *Statistical inference for reciprocal gamma diffusion process*, J. Statist. Plann. Inference, **140**(2010), 30–51.

- [3] N. N. Leonenko, **N. Šuvak**, *Parameter estimation for reciprocal gamma and Student diffusion processes*, Proceedings of the 16th European Young Statisticians Meeting, Bucharest, Romania, August 24–28, 2009, pp. 95–99.