STOCHASTIC ANALYSIS and APPLICATIONS

A.S.E. BUCHAREST, ROMANIA

DECEMBER 17 – 18, 2014

Supported by a CNCSIS – UEFISCDI grant, PNII-ID-PCCE-2011-2-0015,
“Stochastic Analysis and Parameter Estimation in Systems with Memory”
Workshop on

STOCHASTIC ANALYSIS and APPLICATIONS

A.S.E. BUCHAREST, ROMANIA

DECEMBER 17 – 18, 2014

ORGANIZERS

Ciprian TUDOR and Mihai N. PASCU

Bucharest Academy of Economic Studies

Transilvania University of Brașov

# CONFERENCE PROGRAM

<table>
<thead>
<tr>
<th>TIME</th>
<th>PROGRAM</th>
<th>PLACE</th>
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<tbody>
<tr>
<td>TUESDAY, DECEMBER 16, 2014</td>
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<tr>
<td>15:00 – 19:30</td>
<td>Arrival and registration</td>
<td>Golden Tulip Hotel¹</td>
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<tr>
<td>19:30 – 21:00</td>
<td>Dinner</td>
<td>Golden Tulip Hotel</td>
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<td>WEDNESDAY, DECEMBER 17, 2014</td>
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<tr>
<td>8:45 – 9:20</td>
<td>Registration</td>
<td>Room 2416²</td>
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<tr>
<td>9:20 – 9:30</td>
<td>Opening</td>
<td>Room 2416</td>
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<tr>
<td>9:30 – 10:10</td>
<td>B. MASLOWSKY</td>
<td>Room 2416</td>
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<tr>
<td>10:15 – 10:55</td>
<td>I. POPESCU</td>
<td>Room 2416</td>
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<tr>
<td>11:00 – 11:20</td>
<td>Coffee break</td>
<td>Room 2416</td>
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<tr>
<td>11:20 – 12:00</td>
<td>Y. SWAN</td>
<td>Room 2416</td>
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<tr>
<td>12:05 – 12:20</td>
<td>I. M. POP</td>
<td>Room 2416</td>
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</table>

¹ Address: Calea Victoriei 166, Bucharest. Phone: (+40) 21 212 5558

² Address: 4th floor in the Faculty of Cybernetics, Calea Dorobanților, Nr. 15-17, Bucharest.
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<thead>
<tr>
<th>TIME</th>
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<tr>
<td>12:30 – 14:00</td>
<td>Lunch</td>
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<tr>
<td>14:15 – 14:55</td>
<td>J. M. BARDET</td>
<td>Room 2416</td>
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<tr>
<td>15:00 – 15:45</td>
<td>H. LISEI</td>
<td>Room 2416</td>
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<tr>
<td>15:50 – 16:05</td>
<td>N. STOIAN</td>
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<td>16:25 – 16:55</td>
<td>D. COVEI</td>
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<td>17:00 – 17:45</td>
<td>J. VIVES</td>
<td>Room 2416</td>
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<tr>
<td>20:00 – 22:00+</td>
<td>Dinner</td>
<td>Carul cu Bere Restaurant³</td>
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**TUESDAY, DECEMBER 18, 2014**

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<tr>
<td>9:00 – 9:40</td>
<td>P. IMKELLER</td>
<td>Room 2416</td>
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<tr>
<td>9:45 – 10:15</td>
<td>B. IFTIMIE</td>
<td>Room 2416</td>
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<tr>
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<td>Coffee break</td>
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<tr>
<td>10:45 – 11:25</td>
<td>X. BARDINA</td>
<td>Room 2416</td>
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<tr>
<td>11:30 – 12:20</td>
<td>M. BUICULESCU</td>
<td>Room 2416</td>
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³ Address: Stavropoleos 5, Bucharest. Phone: (++40) 21 313 7560 or (++40) 726 282 373
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<td>14:15 – 15:05</td>
<td>A. AYACHE</td>
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<td>15:10 – 15:40</td>
<td>A. AGAPIE</td>
<td>Room 2416</td>
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<tr>
<td>15:45 – 16:00</td>
<td>O. RACHIERU</td>
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<tr>
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FRIDAY, DECEMBER 19, 2014

| 8:00 – …    | Departure of participants |
Probabilistic Cellular Automata

Alexandru AGAPIE

A.S.E. Bucharest, Romania
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Abstract

Cellular automata are binary lattices used for modeling complex dynamical systems. The automaton evolves iteratively from one configuration to another, using some local transition rule based on the number of ones in the neighborhood of each cell. With respect to the number of cells allowed to change per iteration, we speak of either synchronous or asynchronous automata. If randomness is involved in some degree in the transition rule, we speak of probabilistic automata, otherwise they are called deterministic. Either type of cellular automaton we are dealing with, the main theoretical challenge stays the same: starting from an arbitrary initial configuration, predict the end-configuration. If the automaton is deterministic, the outcome simplifies to one of two configurations, all zeros or all ones. If the automaton is probabilistic, the whole process is modeled by a finite homogeneous Markov chain and the outcome is the corresponding stationary distribution. Based on our previous results for the asynchronous case - connecting the probability of a configuration in the stationary distribution to its number of zero-one borders - we present numerical and theoretical insight into the long-term behavior of synchronous cellular automata.

Linear Multifractional Stable Motion: an a.s. uniformly convergent estimator for Hurst function

Antoine AYACHE

Université de Lille 1, France
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Abstract

Since the middle of the 90’s, multifractional processes have been introduced for overcoming some limitations of the well-known Fractional Brownian Motion model due to the constancy in time of its Hurst parameter $H$; in their context, this parameter becomes a Hölder continuous function $H(\cdot)$ depending on the time variable $t$. Global and local sample path roughness of a multi-fractional process are determined by values of its parameter $H(\cdot)$; therefore, since about two decades, several authors have been interested in their statistical estimation, starting from discrete variations of the process. Because of complex dependence structures of variations, in order to show consistency of estimators one has to face challenging problems.
The main goal of our talk, is to introduce in the setting of the symmetric alpha-stable non-anticipative moving average Linear Multifractional Stable Motion (LMSM), where alpha belongs to the interval $(1, 2)$, a new strategy for dealing with such kind of problems. In contrast with previously developed strategies, this new one, does not require to look for sharp estimates of covariances related to functionals of variations; roughly speaking, it consists in expressing variations in such a way that they become independent random variables up to negligible remainders. Thanks to it, we obtain:

(i) a strongly consistent estimator of $\min H(t)$ over any compact interval $I$;
(ii) more importantly, a strongly consistent estimator of the whole function $H(\cdot)$, which converges almost surely in the sense of the uniform norm. Such kind of almost sure result in $L$-infinity-norm is rather unusual in the literature on statistical estimation of functions.

Asymptotic behavior of the Whittle estimator for the increments of a Rosenblatt process

Jean-Marc BARDET
Université de Paris 1 Panthéon-Sorbonne, France
Email: Jean-Marc.Bardet@univ-paris1.fr

Abstract

We first provide some key-results about the parametric and semi-parametric estimation of the Hurst parameter of long-memory processes. Then, we consider the particular case of the estimation of the self-similarity index of the Rosenblatt process by using the Whittle estimator. Via chaos expansion into multiple stochastic integrals, we establish a non-central limit theorem satisfied by this estimator. We illustrate our results by numerical simulations.

On the Kac-Stroock approximations

Xavier BARDINA
Universitat Autonoma de Barcelona, Spain
Email: bardina@mat.uab.cat
Abstract

Let \( \{N(t), t \geq 0\} \) be a standard Poisson process and consider, for all \( n \in \mathbb{N} \) the process:

\[
x_n(t) := \frac{1}{\sqrt{n}} \int_0^t (-1)^{N(u)} \, du, \quad t \in [0,T].
\]

Stroock proves in 1982 that the processes \( x_n \) converge in law to a standard Brownian motion. These processes were introduced by Kac in 1956 in order to obtain a solution of the telegraph equation from a Poisson process.

We find in the literature a lot of generalizations of the Stroock result in three directions:

- Modifying the processes \( x_n \) in order to obtain approximations of other Gaussian processes.
- Proving convergence in a stronger sense that the convergence in law in the space of continuous functions.
- Weakening the conditions of the approximating processes, that is, to find generalizations of the processes \((-1)^{N(u)}\) that also converge to the Brownian motion.

In this talk we will review some of these results and we will analyze, in more detail, a result in the third direction. More precisely we will show that we can change the Poisson process in the original result by a Lévy process.

Heat kernel estimates for unimodal Lévy processes

Krzysztof BOGDAN

Wroclaw University of Technology, Poland

Email: Krzysztof.Bogdan@pwr.edu.pl

Abstract

I plan to communicate sharp estimates for:

1. the convolution semigroups with unimodal Lévy measures and certain scalings of the Lévy-Khintchine exponent;
2. nonnegative superharmonic functions (barriers) of the corresponding Lévy processes;
3. their Dirichlet heat kernels for smooth domains.

This is a joint work with Tomasz Grzywny and Michał Ryznar, contained in a series of 3 papers [http://arxiv.org/find/math/1/au:+Bogdan_K/0/1/0/all/0/1](http://arxiv.org/find/math/1/au:+Bogdan_K/0/1/0/all/0/1).
On the existence of quasi-stationary distributions for general Markov processes

Mioara BUICULESCU

Center for Mathematical Statistics, Bucharest, Romania
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Abstract

Quasi-stationary distributions (in short QSDs) were introduced to describe the long-term behaviour of processes that die out almost surely, but preserve a sort of stationarity up to their death. We discuss two different approaches to the existence of QSDs. The first one developed in [1] and [2] is based on associating with the given process and a probability measure on its state space a “revived” recurrent process having an invariant probability measure $\mu$. A QSD becomes in this context a fixed point of the mapping $\mu \rightarrow \tilde{\mu}$. The second approach (classical for Brownian motion killed at the exit from a regular domain of finite mass) is based on the spectral analysis for symmetric Markov processes satisfying the condition of absolute continuity (3). We remove these two restrictions and use instead of the theory of compact operators the more general one of uniformly integrable operators developed in [4]. Finally we apply this second approach to regular step processes with arbitrary state spaces.

References


Some recent results for a class of nonlocal elliptic problems

Dragos COVEI

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Abstract

We discuss some recent existence results obtained for a class of nonlocal elliptic boundary value problems with zero Dirichlet boundary conditions.

Robust utility maximization in a model with unpredicted evolutions of the interest rate

Bogdan IFTIMIE
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Email: iftimieb@csie.ase.ro

Abstract

We are dealing with an optimization problem in which investors take into account uncertainty in the underlying model, by defining in a suitable way their preferences (the set of priors). The interest rate is subject to (possible) several regime switchings which take place at some random times which are not stopping times with respect to the Brownian filtration which drives the risky asset. Our framework is non-Markovian and classical results concerning HJB approach cannot be applied. We prove via a direct approach that the value function of the original problem and the value function of a suitable auxiliary problem (which is defined by taking into account the budgetary constraint) are in duality. The former problem is solved using BSDEJ techniques. We obtain quite explicit formulas for the optimal portfolio and the optimal wealth. We consider also a particular case with deterministic coefficients (between the changes of regimes) and when the set of priors is a rectangle. Our results are then compared with those obtained by Hernandez-Hernandez and Schied in a Brownian setting and a Markovian framework.

This research was supported by the project ID-303/5.10.2011.

A Fourier analysis based approach of integration

Peter IMKELLER
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Abstract

In 1961, Ciesielski established a remarkable isomorphism of spaces of Hölder continuous functions and Banach spaces of real valued sequences. The isomorphism can be established along Fourier type expansions of (rough) Hölder continuous functions by means of the Haar-Schauder wavelet. We will use Schauder representations for a pathwise approach of the integral of one rough function with respect to another one, via Ciesielski’s isomorphism. In a more general and analytical setting, this approach of rough path analysis can be understood in terms of Paley-Littlewood decompositions of distributions, and Bony paraproducts in Besov spaces. In a stochastic analysis context, the resulting integral is closely related to Stratonovich’s or Ogawa’s concepts. To recover Itô’s integral for instance in Föllmer’s pathwise approach requires some additional knowledge of the quadratic variation.

This talk is based on work in progress with M. Gubinelli and N. Perkowsk (Université Paris-Dauphine).

Results for stochastic Schrödinger equations with cubic nonlinearities

Hannelore LISEI

Babeș-Bolyai University, Cluj-Napoca, Romania
Email: hanne@math.ubbcluj.ro

Abstract

Stochastic Schrödinger equations with cubic nonlinearities perturbed by multiplicative Gaussian noise are investigated. In order to prove the existence and uniqueness of the variational solution, a further process will be introduced which allows to transform the multiplicative Schrödinger problem into a pathwise one. We use Galerkin approximations and compact embedding results. We also investigate the long-time behavior of the solution.

Linear stochastic evolution equations with Volterra type noise

Bohdan MASLOWSKI

Charles University, Czech Republic
Email: maslow@karlin.mff.cuni.cz
Abstract
Linear stochastic equations in Hilbert spaces are considered in the case when the driving process is a general Volterra type Gaussian process. Under suitable conditions the stochastic convolution integrals defining the solutions to linear equations (with additive noise) are shown to exist as regular processes. Typically, the general results may be applied to fractional Brownian motion, Liouville fractional Brownian motion and other Volterra processes. In the second part SEEs with bilinear one-dimensional noise are studied. Here we restrict ourselves to fractional Brownian motions as driving processes. Some basic differences from the Markovian cases are illustrated on examples. As examples the linear stochastic parabolic systems (including some of those with boundary/pointwise noise) and hyperbolic systems are considered.

On the Gaussian product conjecture
Guillaume POLY
Université de Rennes 1, France
Email: guillaume.poly@univ-rennes1.fr

Abstract
The Gaussian product conjecture asserts that for some Gaussian vector \((X_1, ..., X_d)\) with any covariance, and any even integer \(p\), it holds that 
\[
E(X_1^p \cdots X_d^p) > E(X_1^p) \cdots E(X_d^p).
\]
We will discuss this problem, using recent techniques based on Malliavin calculus and spectral theory. We will also point out the link between this conjecture and some open problems of linear algebra.

Stochastic variational approach to an electrothermal optimization problem with periodic structure
Mihail-Ioan POP
Transilvania University of Brașov, Romania
Email: mihailp@unitbv.ro

Abstract
We study a periodic structure from the point of view of its electrical and thermal properties, for the purpose of designing a conductor element with a given electrical resistance and extremal heat conduction.

We consider a coupled system of equations describing the electrical and thermal properties of the structure, and we investigate the stationary case. We use an asymptotic expansion approach and a coupling of stochastic processes in order to homogenize the system of equations. We also use variational formulations in terms of stochastic processes involved.
References


From Girsanov to gradient estimates

Ionel POPESCU
Georgia Tech, USA, and IMAR Bucharest, Romania
Email: ioionel@gmail.com

Abstract

On Riemannian manifolds, using probability to estimate gradients is pretty standard. However, for more refined estimates as for instance, the Hamilton’s inequalities, the standard proofs are not enough. Following an idea of E. P. Hsu, I will show that Girsanov transformation can give interesting results and eventually refinements of Hamilton’s inequality.

This is joint work with Elton Hsu.

Some results on the Hot Spots conjecture in triangular domains

Oana RACHIERU

Transilvania University of Braşov, Romania
Email: oana.rachieru@unitbv.ro

Abstract

We present some recent advances on the Hot Spots conjecture of J. Rauch in the particular case of triangular domains.
References


Asymptotic distribution of a Markov chain

Nadia STOIAN

*Transilvania University of Braşov, Romania*

E-mail: nadia_stoian@yahoo.com

Abstract

We present a model for a Markov chain with a finite/countable state space and we study its ergodic properties. The model describes a “spin” (a direction) attached to a reflecting Brownian motion, viewed as a Brownian motion on a two-sided planar domain, which changes direction when the Brownian motion moves from one side to the other.

Stein’s method and the influence of the prior

Yvik SWAN

*Université de Liege, Belgium*

Email: ysvan@ulg.ac.be

Abstract

It is well-known that with well-identified parameters and large simple sizes, reasonable choices of prior distributions will have minor effects on posterior inferences. We propose a method to quantify this waning influence of the choice of the prior via a general canonical formulation of Stein’s method.
Decomposition of the pricing formula for stochastic volatility models based on Malliavin-Skorohod type calculus

Josep VIVES

Universitat de Barcelona, Spain
Email: josep.vives@ub.edu

Abstract

The goal of the talk is to present in detail a method that, for a financial derivative under a certain stochastic volatility model, allows to obtain a decomposition of its pricing formula that distinguishes clearly the impact of correlation and jumps. This decomposed pricing formula, usually called Hull and White type formula, can be potentially useful for model selection and calibration. The method is based on the obtention of an ad-hoc anticipating Itô formula.
LIST OF PARTICIPANTS

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