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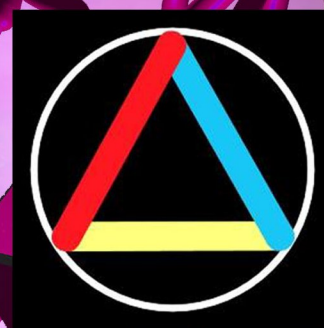
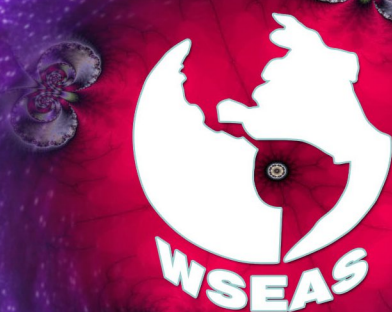
**Prof. Anca Croitoru, ROMANIA**

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# **RECENT ADVANCES IN MATHEMATICS AND COMPUTERS IN BUSINESS, ECONOMICS, BIOLOGY & CHEMISTRY**

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**"G. Enescu" University, Iasi, Romania, June 13-15, 2010**

- **Proceedings of the 11<sup>th</sup> WSEAS International Conference on Mathematics and Computers in Business and Economics (MCBE '10)**
- **Proceedings of the 11<sup>th</sup> WSEAS International Conference on Mathematics and Computers in Biology and Chemistry (MCBC '10)**





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**Preface**

This year the 11th WSEAS International Conference on MATHEMATICS AND COMPUTERS IN BUSINESS AND ECONOMICS (MCBE '10) & 11th WSEAS International Conference on MATHEMATICS AND COMPUTERS IN BIOLOGY AND CHEMISTRY (MCBC '10) were held at "G. Enescu" University, Iasi, Romania, June 13-15, 2010. The conferences remain faithful to their original idea of providing a platform to discuss mathematical methods, computational techniques, statistical methods, mathematical or computer analysis of experimental methods, mathematical models (deterministic and stochastic), modelling and simulation, experiments and computer analysis, optimization, advanced mathematics (differential geometry, operator analysis, non-linear analysis and chaos), computer science (data bases, data structures, software engineering, reliability), practical methods, empirical and semi-empirical methods, bio-engineering, chemical engineering etc. with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be indexed by ISI. Please, check it: [www.worldses.org/indexes](http://www.worldses.org/indexes) as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors





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## Plenary Lecture 1

### Option Pricing Model Based on Telegraph Processes



#### **Professor Nikita Ratanov**

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**Abstract:** A new class of financial market models is proposed. These models are based on continuous time random motions with alternating constant velocities  $c_{\pm}$  (so called "telegraph" process) and with jumps  $h_{\pm}$  occurring when the velocities are switching. While such markets may admit an arbitrage opportunity, the model under consideration is arbitrage-free and complete if directions of jumps in stock prices are in a certain correspondence with their velocity and interest rate behaviour. In the framework of this model we capture bullish and bearish trends in a market evolution. Values  $h_{\pm}$  describes sizes of possible crashes, jumps and spikes. Thus, we study a model that is both realistic and general enough to enable us to incorporate different trends and extreme events. We construct financial market model based on the random processes with finite velocities which possess a simplicity of Black-Scholes model. Replicating strategies for European options are constructed in detail. Explicit formulae for option prices are obtained. Some peculiarities as memory effects and a detailed description of volatility are discussed also.

#### **Brief Biography of the Speaker:**

Nikita Ratanov is affiliated as a professor of Economics faculty of University of Rosario, Bogota, Colombia. He was trained in Moscow State University (Diploma, 1976; PhD degree in Mathematics, 1984). He has DrSci degree also (Russian Academy of Sciences, 1999).

His research interests concern with stochastic analysis with application in financial modelling and mathematical physics. He is author of more than 70 papers published in reviewed journals or presented at international conferences. He wrote two textbooks of stochastic analysis in financial modelling for students of economics and applied mathematics faculties (in Russian and in Spanish).

## Plenary Lecture 2

### The Deterministic, Stochastic and Fuzzy Economic Games



#### Professor Mihaela Neamtu

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**Abstract:** In this paper the static model of the Cournot duopoly with tax evasion, the dynamic model of the Cournot duopoly with tax evasion and the rent seeking game with tax evasion and time delay are presented. A study for the local stability of the stationary states is carried out. Also, the stochastic approach is taken into consideration. A Wiener process is used to describe the stochastic model, as the noise has a stabilization effect. The dynamics are studied in terms of stochastic stability in the stationary state, by constructing the Lyapunov exponent, depending on the parameters that describe the model. Also, the Lyapunov function is determined in order to analyze the mean square stability. The numerical simulations justify the theoretical results. Moreover, the hybrid models are associated to the deterministic models using the Wiener and Liu processes. Numerical simulations are performed for the above mentioned processes. Finally, conclusions regarding the economic processes are provided.

#### Brief Biography of the Speaker:

MIHAELA NEAMTU was born in Timisoara (Romania) on 1971. She graduated in 1995 the Faculty of Mathematics, West University of Timisoara. In 2001 she obtained the title of Ph.D in mathematics. She followed a didactic career at the Faculty of Economics and Business Administration, West University of Timisoara, Romania and she is currently a professor. She has been a visiting Professor for short periods of time at The Nottingham Trent University, Economics & Politics (Great Britain) and Faculty of Mathematics, Bonn (Germany). Professor Mihaela Neamtu has over 50 articles published in Journals and Proceedings of the International Conferences and 3 monographs; she has been a regular referee of papers for several International Journals and a reviewer of Mathematical Reviews (MathSciNet). She has been participating in 10 multiannual grants (1 of them is international), in 8 as a member and in 2 as a director. Her main academic interests are in dynamical systems and applications in biology and economy, geometrical mechanics.

## Plenary Lecture 3

### Endotoxin Tolerance: Mathematical Models



**Professor Mircea Olteanu**

Mathematics Department

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Co-authors: Paul Flondor, Radu Dobrescu, Catalin Vasilescu

**Abstract:** Endotoxin tolerance is an important phenomenon of innate immunity. It is usually defined as “a reduced responsiveness to a lipopolysaccharide (LPS) challenge following a first encounter with endotoxin.” The actors of the endotoxin tolerance are a Gram-negative bacterial lipopolysaccharide (LPS), the proinflammatory cytokines (the best marker of the inflammatory process is considered to be the TNF- $\alpha$ ) and the downregulating factors. It has to be noted that there are three possible outcomes at a secondary challenge with endotoxin: 1) the first and the second responses have the same magnitude, 2) the second response is greater than the first one and 3) the second response is lower than the first one. This last outcome is known as the typical endotoxin tolerance phenomenon. There are many reasons which explain the interest in understanding the endotoxin tolerance (for example, the connections with sepsis). It would be of great help to have a simple but good enough mathematical model for testing and simulating endotoxin tolerance in various reported situations and also for a better understanding of the factors acting during this complex phenomenon. In some previous works the authors introduced an original mathematical (ODE) model of endotoxin tolerance. The aim of this lecture is to present this model and some new improvements together with applications (mainly in sepsis). Our original mathematical model of the endotoxin tolerance is based on a generalized version of the Michaelis - Menten - Hill equations for enzymatic reactions. This is a nonlinear and non autonomous ODE - time delayed system with LPS as an input. We also tried to keep our model as simple as possible; the model could be, of course, developed to a more sophisticated one. In order to test our model we considered several typical scenarios for the input (LPS challenge) such as: in vivo, in vitro, immune paralysis (clinical sepsis). In each case, the mathematical simulation fit well-enough with the reported experimental data.

#### **Brief Biography of the Speaker:**

Mircea Olteanu is professor at the Dept. of Mathematics of the Politehnica University of Bucharest, Romania. His area of study includes group representation theory, time invariant systems, nonlinear analysis of time series and mathematical modeling. He is the author of more than 40 scientific papers. Regarding the mathematical modeling of the endotoxin tolerance (the subject of this plenary lecture) he published several studies (as coauthor with Paul Flondor, Catalin Vasilescu, Radu Dobrescu) in Amer. J. of Surgery, Inflammation Research, Journal of Critical Care, Chirurgia.

## Plenary Lecture 4

### Molecular Simulation and Experimental Approaches to Molecules and Ions Confined in Hydrophobic Solid Nanospaces for Sustainable Engineering



**Professor Katsumi Kaneko**

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**Abstract:** Nanoporous solids such as activated carbon fiber (ACF), single wall carbon nanotube(SWCNT), double wall carbon nanotube(DWCNT), single wall carbon nanohorn(SWCNH), and metal organic framework (MOF) s have nanoscale spaces offering the deep interaction potential wells for molecules and ions, which can be helpful to construct sustainable technology. In this lecture, unusual adsorption behaviors for molecules and ions which have been shown with experimental techniques and molecular simulation.

Even supercritical gas molecules of H<sub>2</sub> and CH<sub>4</sub> are physically adsorbed predominantly in the nanospaces of ACF, SWCNT, and DWCNT above the bulk critical temperature, giving their dense states comparable to the bulk liquid or solid phase. Typical examples will be presented. Reactivated ACF shows superior adsorptivity for supercritical CH<sub>4</sub>: 190 vol.% at 3.5 MPa and 303 K is larger than the DOE target value (180 vol.%). The relationship between supercritical H<sub>2</sub> adsorptivity and nanostructure will be given: DWCNT shows better adsorptivity than SWCNT and intercalation of C<sub>60</sub> enhances the adsorptivity of SWCNT due to increase of the interstitial nanoporosity. The nanospaces show a marked quantum molecular sieving effect for H<sub>2</sub> and D<sub>2</sub>, which are evidenced for SWCNH, SWCNT, and Cu-MOF with quantum grand canonical Monte Carlo simulation.

Water adsorption in nanogate-donated SWCNH indicates the new mechanism of cluster-chain-cluster on penetration of 0.4 nm-gate of the SWCNH wall. This mechanism is supported by molecular dynamics.

The effect of addition of organic electrolytes on the structure of organic solvent propylene carbonate (PC) was examined by synchrotron X-ray and reverse Monte Carlo simulation; addition of the electrolytes promotes orientation of PC molecules in the slit nanospaces of 1 nm in width.

#### **Brief Biography of the Speaker:**

Katsumi Kaneko is a professor of chemistry (physical chemistry), Department of Chemistry, Graduate School of Science, Chiba University. He received Dr. of Science from University of Tokyo. He developed new characterization methods for nanoporous materials and elucidated adsorption states of molecules and ions; he applied molecular and solid state sciences to adsorption to establish nanospace molecular science.

He has been an Editor of Adsorption Science and Technology and currently on the Advisory Board of several international journals such as Carbon, Journal Experimental Nanoscience, Adsorption, and the Journal of Porous Materials, and has been elected to a directorship of the Chemical Society of Japan, whilst he has previously been a Chairman of the Division of Colloid and Interface Chemistry of the Chemical Society of Japan, and President of the International Adsorption Society (2005-2008).

His work has been reported in more than 380 international journal papers and more than 40 invited international conference presentations, and has been recognized by an award from the Chemical Society of Japan in 1999 and by the American Carbon Society, who awarded him the Charles E. Pettinos Award in 2007.

## Plenary Lecture 5

### DNA Combination and Recombination State



#### **Professor Jelenka Savkovic-Stevanovic**

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**Abstract:** The discovery that genetic information is coded along the length of a polymeric molecule composed of only four types of monomeric units is one of the major scientific achievements of last century. The content of DNA resides in the sequence in which these monomers, purine and pyrimidine deoxyribonucleotides are ordered.

A particular sequence of nucleotides says the same thing to one organism as it does to another, differences between organisms reflect genetic programs of different nucleotides sequences.

The concomitant advances in theory, measuring systems, and DNA sequencing techniques bring new perspectives to the helix-to-coil transition. Using the advanced theory, one can evaluate the stability of individual base pairs, it is also possible to estimate the probability of each base pair being in an open state. These stability map and base pair association opening provide unique information about the roles of specific regions in various biologically important processes, such as replication, transcription, recombination, and so on.

Under ordinary condition, native DNA in an aqueous solution takes a double stranded structure, known as B-form. This double stranded structure is maintained by two main forces hydrogen bonds between complementary pairs on opposite strands, and stacking interactions between neighboring base pairs. Although the contributions of these and other interactions to stabilizing DNA double helix have not yet been critically evaluated, it is believed that the stacking interaction makes the dominant contribution.

Since the latter are closer to physiological conditions, the relationship between functional and thermodynamic properties of specified regions on a DNA molecule is better illustrated in the base pair opening profile.

The two complementary strands comprising the double helix can be separated into single stranded random coils in various ways. Since the random coils have a larger degree of conformational freedom than the ordered double-stranded structure, the ordered structure is disrupted with an increase in temperature or denaturing agents.

While a thermal stability map reflects status of DNA molecules during the helix-coil transition, a base pair opening profile represents their state under premelting conditions.

The presence of massive numbers  $10^{12}$  of molecules representing each particular edge and vertex of the graph allowed for all possible molecular combinations to form simultaneously with their reaction bath.

#### **Brief Biography of the Speaker:**

Full professor, University of Belgrade, Faculty of Technology and Metallurgy, Serbia. Education: B.Sc. and M.Sc. degree, University of Belgrade, PhD Thesis Technical University of Berlin and University of Belgrade. Research interest: Chemical Engineering and Process System Engineering; Modelling, Analysis, Synthesis, Design, Process optimization; Advanced numerical methods, Control and On-line optimization; Computer Aided Process Operation and Design, Safety and Risk analysis; Information System, Data base, Expert systems, Learning Systems; Informatics, Management; Artificial Intelligence, Neural Networks and Fuzzy logics; Biosystems, Bioinformatics, Pharmaceutical and Biomedical Engineering. Other professional activities: Over 800 papers, 8 books, patentees in the field, Consultant in many companies, Member of many professional organizations, Reviewer of many journals, Citation Index over 200. She has cited in many monographs and she is One of the World's 100 Top Scientists- IBC Cambridge.