



**EDITORS:**

PROF. ROBERTO REVEZIA, UNIV. DEGLI STUDI DI GENOVA, ITALY

PROF. VALERI MLADENOV, TECHNICAL UNIVERSITY OF SOFIA, BULGARIA

PROF. NIKOS MASTORAKIS, TECHNICAL UNIVERSITY OF SOFIA, BULGARIA

# RECENT ADVANCES IN SYSTEM SCIENCE AND SIMULATION IN ENGINEERING

**HOST AND SPONSOR:**

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PROCEEDINGS OF THE 8<sup>th</sup> WSEAS INTERNATIONAL CONFERENCE ON  
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**Editors:**

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**Preface**

This year the 8th WSEAS International Conference on SYSTEM SCIENCE and SIMULATION in ENGINEERING (ICOSSSE '09) was held in the University of Genova, Genova, Italy, October 17-19, 2009. The conference remains faithful to its original idea of providing a platform to discuss systems theory, control systems, information systems, multidimensional systems, man-machine systems, intelligent machines etc. with participants from all over the world, both from academia and from industry.

Its 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 this conference 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.

A Conference such as this 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

### Measurements on the Ground and Mathematical Simulation of Voltages Induced by High Voltage Aerial Power Lines Working on Parallel and Narrow Routes



#### Professor Filippo Neri

Department of Computer and System Science  
University of Naples "Federico II"  
via Claudio 21  
80125 Napoli (NA)  
Italy  
E-mail: [filipponeri@yahoo.com](mailto:filipponeri@yahoo.com)

**Abstract:** The flexibility and the adaptability of the software agent paradigm when coming to the study and the simulation of complex systems, allowed us to direct our research effort, that aims to understand the basic drivers of emergent behavior in complex systems, to the investigation of financial markets.

In particular, we have focused our attention to the following research question: how the sentiments of greed and fear in investors affect the overall behaviour of a financial market?

Essentially, we want to understand:

- a) if and how the volatility in a financial market, as that observed in 2008, could be explained in term of the spread of fear and of greed among the population of investors;
- b) and, also, how effective a software agent simulator would be in reproducing the behaviour of a financial market by exploiting a well thought interaction among simple investors-agents.

During the talk we will also show and comment about some of the empirical simulations conducted so far.

#### Brief Biography of the Speaker:

Prof. Filippo Neri is currently a professor in Computer Science at the Department of Computer and System Science of University of Naples "Federico II".

Prof. Filippo Neri has wide experience in the area of artificial intelligence, machine learning, and software agent simulation. He had the opportunity to work both in academic and industrial environments including Ericsson's and Unilever's R&D centers and across three countries in the European Union (Italy, Ireland and UK). He is currently setting up a spin-off company providing consulting services for information technology strategy and management while at the same time advancing his academic career.

He has studied and visited at several important academic institutions including Carnegie Mellon University, MIT, Imperial College London, University of Milano, University of Torino.

He is a Marie Curie Fellow and an ADI associate, the Italian PhD association. He is a founding member of initiatives aiming to close the gap between academia and the business application of research results.

Finally he has served in the program committees and as reviewer at several international conferences and he is author of more than 50 internationally reviewed publications.

## Plenary Lecture 2

### Linear Control Systems Over Spaces of Regulated Functions



#### Professor Valeriu Prepelita

University Politehnica of Bucharest  
Department of Mathematics I  
Splaiul Independentei 313, Bucharest  
ROMANIA  
E-mail: vprepelita@mathem.pub.ro

**Abstract:** A model of generalized linear control systems is considered, which is represented by matrices with elements functions of bounded variation and controls over the space of regulated functions (i.e. functions which possesses finite one-sided limits on a given interval).

The Perron-Stieltjes integral with respect to the set of regulated functions (which include the set of functions of bounded variation) was defined in [12]. This integral is equivalent to the Kurzweil integral (see [2], [8] and [9]).

In this paper, using the results of M.Tvrđy ([10], [11]) concerning the properties of the Perron-Stieltjes integral with respect to regulated functions and the differential equation in this space, the formulas of the states and of the general response of the control systems are obtained. This allows us to extend in this framework the concepts of reachability and observability (see for instance [1] and [6]). These fundamental concepts are analysed by means of two suitable controllability and observability Gramians. The duality between the concepts of controllability and observability is emphasized as well as Kalman's canonical form. The spaces of reachable and observable states are described.

The minimal energy transfer is studied and the optimal control is provided. In the case of completely observable systems a formula is obtained which recovers the initial state from the exterior data. It is emphasized that these systems are generalizations of the classical linear systems described by differential equations with controls. The considered approach seems to be the most general framework in which the linear control systems can be studied.

Linear boundary value (acausal) systems are studied in the same framework [3]. Semiseparable kernels are associated to acausal systems with well-posed boundary conditions. Minimal realizations of semiseparable kernels are characterized as well as the irreducibility of the acausal systems. Adjoint systems are defined and an input-output operator is provided.

A Peano-Baker type formula is obtained for the calculus of the fundamental matrix of the generalized linear differential systems [4].

This study can be continued in many directions such as stability, positivity, multidimensional generalized systems [5], 2D generalized differential-difference systems [7], linear quadratic optimal control etc.

#### Brief Biography of the Speaker:

Valeriu Prepelita graduated from the Faculty of Mathematics-Mechanics of the University of Bucharest in 1964. He obtained Ph.D. in Mathematics at the University of Bucharest in 1974. He is currently Professor at the Faculty of Applied Sciences, the University Politehnica of Bucharest, Head of the Department Mathematics-Informatics. His research and teaching activities have covered a large area of domains such as Systems Theory and Control, Multidimensional Systems, Functions of a Complex Variables, Linear and Multilinear Algebra, Special Functions, Ordinary Differential Equations, Partial Differential Equations, Operational Calculus, Probability Theory and Stochastic Processes, Operational Research, Mathematical Programming, Mathematics of Finance.

Professor Valeriu Prepelita is author of more than 100 published papers in refereed journals or conference proceedings and author or co-author of 12 books. He has participated in many national and international grants. He is member of the Editorial Board of some journals, member in the Organizing Committee and the Scientific Committee of some international conferences, keynote lecturer or chairman of some sections of these conferences. He is a reviewer for five international journals. He received the Award for Distinguished Didactic and Scientific Activity of the Ministry of Education and Instruction of Romania.

## Plenary Lecture 3

### Theoretical and Experimental Studies and Simulations Regarding the Influence of Tool Thermal Deformation on the Accuracy at Machining



#### Associate Professor Badea Lepadatescu

Faculty of Technological Engineering  
Manufacturing Technology Department  
Transilvania University of Brasov  
Romania

E-mail: danlep2000@yahoo.com

**Abstract:** The paper presents a synthesis of the theoretical and experimental studies of the tool thermal deformation at machining according with the process parameters and tool geometry. The relationships of thermal deformation, graphs to rapid determination of them are a useful data base for designing and optimizing the machining process to achieve the dimensional accuracy required.

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

Address: Str. Calea Bucuresti Nr.96, Bl.206, Sc. D, Ap. 30 Brasov, Romania

Date of birth: 22 March 1951

Work experience: 1998 to present – Assoc. Prof at Transilvania University of Brasov

1982-1998 - Research engineer at transilvania University of Brasov

1976-1982 – Design engineer at ROMAN truck factory in Brasov.

## Plenary Lecture 4

### Reconfigurable Multipoint Forming – A Competitive Manufacturing Process



#### Professor Viorel Paunoiu

Manufacturing Science and Engineering Department,  
“Dunarea de Jos” University of Galati, ROMANIA  
E-mail: viorel.paunoiu@ugal.ro

**Abstract:** Reconfigurable multipoint forming (MPF - multi-point forming) is a flexible manufacturing technology which assures the production of a high sheet metals parts variety with low costs in comparison with the using of the monolithic dies. The main characteristic of the deformation method is given by the active surface discrete design of the forming elements which is composed from a number of pins, vertically aligned, according with the geometry of the part. An efficient control of the process parameters with implications on the part geometry could assure the process competitiveness. Conceptual models for multipoint forming dies reconfigurability based on the study of the rigid/elasto-plastic medii assembly behaviour and their application to design of the new controllable multipoint dies with flexible interface are presented. For this two types of geometrical reconfiguration are presented. First type is based on a surface generation modeling which described a new algorithm for contact points calculus. This assure the primary configuration of the die. The second type are referring to the deformed surfaces reconstruction using advanced reverse engineering based on points clouds inspection. This assure the further configuration of the die taking into account the springback compensation. The models are obtained through a set of simulations, using the finite element analysis. Knowing the relation between the input and output parameters, a control cycle could be applied for developing a sound product with desired geometry. The conceptual control cycle assures the connection between the process parameter and the material response in multipoint deformation. From technologic point of view the major impact of applying such type of control will be the development of a new class of forming tool with superior performances.

#### Brief Biography of the Speaker:

Viorel Paunoiu graduated a 5 years Mechanical Engineering degree program at “Dunarea de Jos” University of Galati (1984); PhD in Industrial Engineering - at “Dunarea de Jos” University of Galati (1998); Training stages at: Ecole des Mines de Paris, CEMEF, Sophia-Antipolis – France (1992); University of Limerick – Irlanda (1998); University of Patras – Greece (2002), University Tor Vergata Roma – Italy (2007). Research fields: Computer aided design of equipments and technologies for plastic deformation; Numerical simulation of the plastic deformation processes; Unconventional technologies for plastic deformation; Energeticaly phenomenons study at manufacturing by plastic deformation (deep drawing, flow forming, extrusion).

Prof. PAUNOIU participated as director or member in over 35 research projects supported by Romanian Ministry of Education and Science; author/co-author of over 10 scientific or didactic books; over 100 scientific papers written or co-authored, published to International/ National Conferences proceedings (France, Hungary, Poland, USA, Moldavia) and Journals. Member of professional and scientific associations: ESAFORM – European Scientific Association for Metal Forming, Romanian Association for Non-Conventional Technologies - ARTN, Romanian Association of Tensometry - ARTENS.



## Plenary Lecture 5

### On the Detection and Quantification of Dynamical Temporal Changes on Complex Signals



#### Professor Vincenzo Niola

Department of Mechanical Engineering for Energetics  
University of Naples Federico II  
Via Claudio 21, 80125 Naples  
Italy  
E-mail: vincenzo.niola@unina.it

**Abstract:** The aim of this lecture is to present the main methodologies employed for quantifying the dynamics of complex signals showing sudden changes, hence not predictable, of their pseudo-deterministic time series.

The techniques which we are going to explain are commonly defined as non-linear.

We illustrate the case of a signal that suddenly present a set of spike (or only one). To better illustrate the problem we will refer to a specific space-time. As showed in the following we will show how we can investigate on complex signals with a detail that, until now, the usual techniques are not capable of achieving. Therefore, the dynamical pattern will be analyzed by means of a particular space-time system: the state or phase space.

As the theory of nonlinear dynamics clearly shows, the space of the state is the natural domain for quantifying the properties of non-linear dynamics. These properties would never be detected in a normal time domain or by the sequential reading of the time series representing the dynamical phenomenon observed.

An important consideration is that the basic measurements proposed are not based on special non-linear models, nor they depend in some way, directly or indirectly, from a priori detailed knowledge of the mechanisms that underlie and are responsible for the generation of data to be analyzed. These techniques belong to those families so called non-parametric.

#### Brief Biography of the Speaker:

Vincenzo Niola is professor of Applied Mechanics at Naples University Federico II since 31 march 1987. After he got an Univerisity Degree in Mechanical Engineering, he started in january 1978 didactics activity as helper at course of Applied Mechanics and Machines et as member of their committee of examination. Since september 1979 he carried on that collaboration as owner of a scholarship from C.N.R. (National Research Council). Since december 1981 to march 1987 he was a researcher carrying on the practice course for Applied Mechanics, taking a part at examination meeting and working as proposer in many degree thesis. Since 1981 to 1984 he carried on his didactics activity as university teacher for Bioengineering course of locomotive apparatus at Orthopaedy and Traumatology specialization school of 2th Department of Medicine and Surgery of Naples University. Since 31 March 1987 is professor of Applied Mechanics at Naples University Federico II, and since A.A. 86/87 to A.A. 92/93 he carried on the Applied Mechanics and Machines course for electronic engineers, and since A.A. 93/94 to today carry on the Applied Mechanics course for computer science engineers. Since A.A. 88/89 to 89/90 he carried on as supply teacher the Applied Mechanics course for building engineers at Salerno Engineering University. By A.A. 94/95 to A.A. 97/98 he carried on as supply professor Tribology course at Naples University Federico II. By A.A. 2001/2002 he holds the chair of Applied Mechanics for University Degree of "Orthopaedic Technician" at 2th Department of Medicine and Surgery of Naples University. Since A.A. 2005/2006 is professor of Tribology and of Complements of Mechanics. During this years Prof. Vincenzo Niola has been the chairman of his courses examination meetings, and was proposer of many degree thesis.. During his activity Prof. Vincenzo Niola was owner of financings from MURST and (in past and present) cooperate scientifically with research corporation and national industries (MERISINTER, MONTEFLUOS, INDESIT, ALENIA, C.I.R.A.). He's scientific member of Naples research unit for PRIN 2003. He's fellow of Italian Association of Theoretical and Applied Mechanics (AIMETA). He's member of IFToMM Linkages on cams committee. He belongs to the International Scientific Committee of the "World Scientific and Engineering Academy and Society (WSEAS). He is President of the WSEAS Italy Chapter on the "Analysis of the Mechanical Systems". He was been Chairman and "invited author" in some session of Internatinal Conferences. He's author of more than 130 national and international papers.

## Plenary Lecture 6

### Advances of Anticipation Models for On-Line Control in Steel Industry



#### Professor Roberto Revetria

DIPTeM, Dipartimento di Ingegneria della Produzione  
Termoenergetica e Modelli Matematici  
Via all'Opera Pia, 15, 16145 Genova, GE  
University of Genoa  
ITALY  
E-mail: roberto.revetria@unige.it

**Abstract:** In a steelmaking real system the production planning is typically manual-loaded into a Gantt chart tracking system by operator, at the start of his shift only. If an accident event occurs during the steelmaking chain, the worker has a few minutes to change his production plan to another one, which typically has not the performance like the first one about cycle time, processes time, transport utilization etc. Then, the experience of worker planner is fundamental to perform the steelmaking chain but not sufficient. A predictive model could be a solution to automate and optimize the production planning activity, reducing possible human error and to speed the process of "remaking" for new chain. The presentation outline the development of a simulation based a system for tracking full production from the hot metal availability to continuous casting process bound. The proposed system does not replace the local systems in singular but incorporates features to higher level by defining three new concepts:

- With real time situation, it shows a photograph of a particular moment in which for each object
- With forecast shows a projection made from a real-time fixed by considering the parameters of walking facilities, the establishment and planning of current flows to achieve. This forecast also takes the name of on-line scenario
- With prediction it indicates a projection from the on-line scenario, considering various steel plant and facilities parameters and planning different casts in order to achieve a target from those mentioned earlier (for example maximization of production Reduction in stocks of cast iron, etc.).

The outlined innovative system will be composed of three modules: the first module will have the duty to construct and present an overview on the current state of facilities and resources of plant, the second module will allow for the representation of the script online, as planning and the current state of facilities, the third module will finally realize the simulation of the system in correspondence to a baseline scenario of the various online.

#### Brief Biography of the Speaker:

Roberto Revetria earned his degree in mechanical engineering at the University of Genoa and he completed his master thesis in Genoa Mass Transportation Company developing an automatic system integrating ANN (Artificial Neural Networks) and simulation with the ERP (Enterprise Resource Planning) for supporting purchasing activities. He had consulting experience in modeling applied to environmental management for the new Bosch plant facility TDI Common Rail Technology in construction near Bari, FORD Motor Company in Detroit and in Severstal Lucchini. During his service in the Navy as officer, he was involved in the development of WSS&S (Weapon System Simulation & Service) Project. He completed his PhD in Mechanical Engineering in 2001 defending his Doctoral thesis on "Advances in Industrial Plant Management" by applying Artificial Intelligence and Distributed Simulation to several Industrial Cases. Since 1998 is active in Distributed Simulation by moving US DoD HLA (High Level Architecture) Paradigm from Military to Industrial application. In 2000 he successfully led a research group first demonstrating practical application of HLA in not dedicated network involving a 8 International University Group. He is currently involved, as researcher, in the DIPTeM of Genoa University, working on advanced modeling projects for Simulation/ERP integration and DSS/maintenance planning applied to industrial case studies (Contracting & Engineering and Retail companies). He is active in developing projects involving simulation with special attention to Distributed Discrete Event, Systems Dynamics and Agent Based Continuous Simulation (SwarmSimulation Agents). He is teaching Modelling & Simulation, VV&A, Distributed Simulation (HLA), Project management in Master Courses Worldwide and he is teaching Industrial Plants Design in University of Genoa Masters' Courses. He is member of WSEAS, SCS, IASTED, ACM, ANIMP, AICE, MIMOS and Liophant Simulation Club. He is Associated Professor in Mechanical Engineering and Logistics. He is currently director of the simulation department in Iso Sistemi srl.