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RECENT ADVANCES IN APPLIED MATHEMATICS



**Proceedings of the AMERICAN CONFERENCE
on APPLIED MATHEMATICS (AMERICAN-MATH '10)**

Harvard University, Cambridge, USA, January 27-29, 2010

**Mathematics and Computers in Science and Engineering
A Series of Reference Books and Textbooks**

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Preface

This year the AMERICAN CONFERENCE on APPLIED MATHEMATICS (AMERICAN-MATH '10) was held at Harvard University, Cambridge, USA, January 27-29, 2010. The conference remains faithful to its original idea of providing a platform to discuss linear algebra and applications, numerical analysis and applications, differential equations and applications, probabilities, statistics, operational research, optimization and applications, algorithms, discrete mathematics, systems, communications, control, computers, education 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 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

Data Correcting and Tolerance Based Algorithms in Combinatorial Optimization



Professor Boris Goldengorin

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Khmelnitsky University of Economics and Business
Ukraine

-Also with-

Operations Department
University of Groningen
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Abstract: Combinatorial Optimization is a well established area of mathematical models and algorithms. In this talk I am going to explain why data correcting and tolerance based algorithms leading to essential computational improvements either for polynomially solvable or NP-hard problems compared to well known branch-and-bound, branch-and-cut, and branch-and-cut-and-price algorithms. Another purpose of this talk is to attract the attention of research community to recently suggested iterative search strategy, namely Climer and Zhang's cut-and-solve (2006) approach, for solving integer linear programming problems by means of general-purpose software, like CPLEX.

Brief Biography of the Speaker:

Boris Goldengorin has the M.Sc. in Computer Science from the Radio Engineering University, Riazan, Russia; M.Sc. in Applied Mathematics from the Moscow University of Mathematics & Electronics; Ph.D. in Standardization and Production Quality Control from the National Institute of Standardization, Moscow, Russia; Sc.D. in Operations Research from the Institute of System Analysis, Russian Academy of Sciences, Moscow, Russia; Ph.D. in Economics from the University of Groningen, The Netherlands. He receives the title of Professor in Engineering Cybernetics from the Ministry of Science, High School and Engineering of Russian Federation, Moscow, Russia; Honorary Doctor of Science degree from the Khmelnsky National University, Ukraine. Dr. Goldengorin is an author of two monographs, and two textbooks and his research articles published in Soviet Math. Doklady, Automation and Remote Control, Journal of Computer and Systems Sciences International (former Engineering Cybernetics), Management Science, Computers & Operations Research, Journal of Global Optimization, Discrete Optimization, Journal of Algebraic Combinatorics, Lecture Notes in Computer Science, European Journal of Operational Research, Handbook of Combinatorial Optimization, Theory of Optimization, Journal of Heuristics, Algorithmic Operations Research, Computers & Mathematics with Applications, Journal of Combinatorial Optimization and a number of other professional journals. Currently he is a Full Professor of Applied Mathematics Department, Khmelnsky National University, Ukraine, and an Associate Professor of Operations Department, University of Groningen, The Netherlands (<http://www.rug.nl/staff/b.goldengorin/index>). He is affiliated to the Advanced Marketing Models Company (http://ammodelsinc.com/core_talent.html) in New York (USA).

Plenary Lecture 2

An Efficient and Precise Numerical-Time-Integration Scheme for Dynamic Analysis



Associate Professor J. D. Yau

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Abstract: In this paper, an efficient and accurate step-by-step time integration algorithm with unconditional stability for dynamic analysis is presented. For a dynamic system under impulsive loadings with load discontinuities, a very small time step is usually required to provide acceptable levels of accuracy in performing time history analysis. To improve this drawback in time integration, the principle of momentum is available to integrate an impulsive loading with respect to time so that the load discontinuity in a time interval can be smoothed out through another expression of external momentum. Besides, time finite element methods feature a larger time step to represent a continuous response over a time step as two nodal responses of the time step. Combining both computational advantages described above, this study presents an improved time integration scheme with the properties of larger time step size and accuracy. From theoretical analysis of stability and accuracy, the proposed algorithm possesses the efficient features of unconditional stability, accuracy, and fast convergence in numerical computation. For simplicity of demonstration, a closed form solution of an excited single-degree-of-freedom (SDOF) system is employed to verify the feasibility and reliability of the new time integration algorithm, with which the numerical results obtained from the Newmark method are compared.

Brief Biography of the Speaker:

Studies:

Ph.D. in Civil Engineering, National Taiwan University

Academic Positions:

Associate professor of Tamkang University in Taiwan

Scientific Activities:

1. Vibrations of high speed rails
2. Geometrical nonlinear analysis of framed structures
3. Structural stability of tapered beams

Dr. Yau is currently an associate professor at Tamkang University in Taiwan. He received his M.S. degree and Ph.D. in civil engineering from National Taiwan University in 1986 and 1996, respectively. His main area of research is on the dynamics of vehicle-bridge interaction with emphasis on high speed railway system, including train-induced resonance phenomenon of bridge response, assessment of running safety and ride quality of traveling vehicles, and influence of ground settlement on a train running over a series of bridge units. He has published over 50 journal papers and articles, and is also the second author of the book: Vehicle-Bridge Interaction Dynamics. His recent research interests focus on vibration control of a running maglev-train and nonlinear dynamics of vehicles traveling over a suspension bridge.

Plenary Lecture 3

Modeling and Hybrid Position-Force Control of Walking Modular Robots



Professor Luige Vladareanu
 Romanian Academy, Institute of Solid Mechanics
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Abstract: The paper presents new concepts and approaches of applied mathematics in modeling and hybrid position-force control for walking modular robots, with developing an open architecture real time control multiprocessor system, in view of obtaining new capabilities for walking robots. A strategy is developed for the dynamic control of the movement of walking robots using the Zero Moment Point method by processing inertial information of force, torque and tilting and by implementing intelligent high level algorithms. The control diagram allows through modeling the generation of compliant walking, real time ZMP compensation in a single phase – the support phase, the leg joint damping control, a stable walking control and controlling the walking position base on the angular velocity of platform. For the modeling of some of the movements of the walking robot, the equation of a simple inverted pendulum was adopted, with a joint in the single support phase, which opposes the dampening forces of the leg joints. For other movements new control strategies were conceived through sequential analyses and local modeling of the movement parameters. The complexity of the movement mechanism of a walking robot was taken into account, being a repetitive tilting process with numerous instable movements and which can lead to its turnover on rough terrain. The control system architecture for the dynamic robot walking is presented in correlation with the control strategy which contains three main real time control loops: balance robot control using sensorial feedback, walking diagram control with periodic changes depending on the sensorial information during each walk cycle, predictable movement control based on a quick decision from the previous experimental data. The results obtained through simulation and experiments show an increase in mobility, stability in real conditions and obtaining of high performances related to the possibility of moving walking robots on terrains with a configuration as close as possible to real situations, respectively developing new technological capabilities of the walking modular robot control systems for slope movement and walking by overtaking or going around obstacles.

Brief Biography of the Speaker:

Luige Vladareanu received his M.Sc. degree in electronics from the Polytechnic Institute Bucharest, in 1977. From 1984, scientific researcher of the Institute of Physics and Material Technology, from 1990, team leader of data acquisition systems and real time control systems of the Institute of Solid Mechanics, from 1991, President General Manager of Engineering and Technology Industrial VTC company. In 1998 he received Ph.D. degree in electronics field from the Institute of Solid Mechanics of Romanian Academy. From 2003, Ministry of Education and Research, executive Department for Financing Superior Education and of Scientific University Research - High Level Expert Consulting for MEC/CNCSIS project, from 2003-2005, member of Engineering Science Committee of Romanian National Research Council, from 2005, Scientific Researcher Gr.I (Professor) of Romanian Academy. His scientific work is focused on real time control in solid mechanics applied in robot trajectory control, hybrid position – force control, multi-microprocessor systems for robot control, acquisition and processing of experimental physical data, experimental methods and signal processing, nano-micro manipulators, semi-active control of mechanical system vibrations, semi-active control of magnetorheological dissipaters systems, complex industrial automations with programmable logical controllers in distributed and decentralized structure. He has published 4 books, over 20 book chapters, 11 edited books, over 200 papers in journals, proceedings and conferences in the areas. Director and coordinator of 7 grants of national research – development programs in the last 5 years, 15 invention patents, developing 17 advanced work methods resulting from applicative research activities and more than 60 research projects. In 1985 the Central Institute of Physics Bucharest awarded his research team a prize for the first Romanian industrial painting robot. He is the winner of the two Prize and Gold of Excellence in Research 2000, SIR 2000, of the Romanian Government and the Agency for Science, Technology and Innovation. 3 International Invention and Innovation Competition Awards and Gold of World's Exhibition of Inventions, Geneva 2007 and 2008, and other 7 International Invention Awards and Gold of the Brussels, Croatia, Bucharest International Exhibition. He received "Traian Vuia" (2006) award of the Romanian Academy, Romania's highest scientific research forum, for a group of scientific papers published in the real time control in the solid mechanics. He is a member of the International Institute

of Acoustics and Vibration (IIAV), Auburn University, USA (2006), ABI/s Research Board of Advisors, American Biographical Institute (2006), World Scientific and Engineering Academy Society, WSEAS (2005), International Association for Modelling and Simulation Techniques in Enterprises-AMSE, France (2004), National Research Council from Romania(2003-2005), etc. He was an organizer of several international conferences such as the General Chair of four WSEAS International Conferences (<http://www.wseas.org/conferences/2008/romania/amta/index.html>) and is serving on various other conferences and academic societies.

Plenary Lecture 4

Phase Diagram for Norms of the Solution Vector of Dynamical Multi-Degree-of-Freedom Systems



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Abstract:

In the present talk, we generalize the $y(t) - \dot{y}(t)$ - phase diagram for the solution $y(t)$ of a single-degree-of-freedom problem to the $\|y(t)\| - \dot{\|y(t)\|}$ - phase diagram for the norm $\|y(t)\|$ of the solution vector $y(t)$ of a multi-degree-of-freedom problem. As the main tool, the differential calculus for norms of vector functions is applied developed by the author in earlier work. The generalization process is described in several steps, each of which is illustrated by a numerical example. The new concept of phase diagram for norms of a vector should be of interest to many scientists, especially from areas of modeling and simulation.

Brief Biography of the Speaker:

Ludwig Kohaupt received the equivalent to the Master Degree (Diplom-Mathematiker) in Mathematics in 1971 and the equivalent to the Ph.D. (Dr.phil.nat.) in 1973 from the University of Frankfurt/Main.

From 1974 until 1979, Dr. Kohaupt was a Teacher in Mathematics and Physics at a Secondary School.

During that time (from 1977 until 1979), he was also an auditor at the Technical University of Darmstadt in Engineering, such as Mechanics, and especially Dynamics.

From 1979 until 1990, he joined the Mercedes-Benz car company in Stuttgart as a Computational Engineer, where he worked in areas such as Dynamics (vibration of car models), Cam Design, Gearing, and Engine Design. Some of the results were published in scientific journals (on the whole, 12 papers and 1 monograph).

Then, in 1990, Dr. Kohaupt combined his preceding experiences by taking over a professorship at the Beuth University of Technology Berlin (formerly known as TFH Berlin), where he is still working.

There, he teaches primarily Mathematics and sometimes Mechanics for Engineers.

In the Spring Term 2005, Prof. Kohaupt was a Visiting Professor at the City College of New York (CCNY).

His actual Research Area is the development of Mathematical tools for Dynamics (especially the development of a Differential Calculus for Norms of Matrix and Vector

Functions) with applications to engineering problems.

In May 2009, Prof. Kohaupt completed his Habilitation at the Technical University of Freiberg and thereby earned the Postdoctoral Degree Dr.rer.nat.habil. The Habilitation Thesis summarizes ten papers from his actual research area.

As to Publications, Prof. Kohaupt's record consists of more than 30 papers in Computational, Applied, Industrial, and Engineering Mathematics published in refereed international journals (in German and English), 2 Monographs, and 2 Patents.

He has Special Expertise in Dynamics in the areas of research, teaching and industrial work.

Prof. Kohaupt is also engaged in Administration. He was Chair of the Service Committee Mathematics for more than 10 years, Head of the Mathematicians Group within the Department II (Mathematics - Physics - Chemistry) of the Beuth University of Technology Berlin for 2 periods of 3 years.

Prof. Kohaupt is further committed to Editorial Work. For instance, he was Referee for the following Scientific Journals or Societies: The Journal of the Franklin Institute (JFI), Journal of Computational and Applied Mathematics (CAM), Journal of Computational Mathematics and Optimization (JOCMO), The Open Applied Mathematics Journal (TOAMJ), and The World Scientific and Engineering Academy and Society (WSEAS).

Moreover, he is a Member of the Editorial Board for the Journal of Computational Mathematics and Optimization as well as The Open Applied Mathematics Journal.

Plenary Lecture 5

On the Optimality of a General Integrated Production Inventory System with Time Varying Demand, Production and Deterioration Rates



Professor Zaid T. Balkhi

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Abstract: Typical models of the production inventory systems assume that lot sizes of raw materials and final products are treated separately which leads to sub-optimization production process. In this paper, a unified inventory model of an integrated production inventory system, where each of production, demand and deterioration rates are general functions of time, is considered. Shortage for the final product is allowed but it is partially backordered. The objective is to find an optimal production schedule that yields a minimum total cost of this integrated system. We develop an exact formula for the total inventory cost per unit of time. Then, we use rigorous mathematical methods to find the optimal solution of the underlying integrated system and to show that this solution is unique and global optimal.

Brief Biography of the Speaker:

Degrees: .B.Sc. in mathematics (Probability and Mathematical Statistics Section) Damascus University 1971-High Diploma in pure mathematics ,Damascus University 1979 - Studying several post graduate courses in Optimization, Probability and Statistics Brussels University 1980 - Dr. of Science in applied mathematics (Belgian Ph.D in applied mathematics- OR oriented) with honors, University of Brussels 1983.

Positions: Professor in King Saud University, College of Science, Department of Statistics and Operations Research since May 2005.,Associate Professor King Saud University, College of Science, Department of Statistics and Operations Research, 1998 -Assistant Professor, King Saud University, College of Science, Department of Statistics and Operations Research, From 1983 to 1998- Demonstrator in Mathematic Department in Damascus University 1979.

Professional Experience: He has about 27 years academic teaching experience in Operations Research, Statistics, and Mathematics, supervising several M.Sc. and PhD thesis., Main contributor in the design and development of the B.Sc. and M.Sc. and PhD Programs in Operations Research And Statistics in the Department of Statistics and Operations Research in King Saud University.(Riyadh - Saudi Arabia), Member in the editorial board of "Journal of Scientific Inquiry" , Acting as a referee for more than 15 specialized and leading international journals (more than 20 papers per year) . He contributed in many Local and International Scientific Conferences and Symposiums ,Plenary Speaker in the 3rd International Conference on COMPUTATIONAL INTELEGENCE(CI09)- Iv.Javakhishvili Tbilisi State University - Georgia .

He contributed in giving consultations in solving local real problems in Saudi Arabia using the OR techniques.

His Research Interests: are in Applied Mathematic (Operations Research Oriented). In particular, Optimal Search problems where he has more than 10 research papers. Recently his research turns to Inventory Control problems with more than 35 publications in scientific and leading journals. He also authored 4 books in Fundamentals of Operations Research, Inventory Control, Game Theory, and Integer Programming.

He is Syrian, and he is establishing a private University in Syria, but he in now working is Saudi Arabia.

Plenary Lecture 6

A Method for a Class of Scheduling Problems



Professor Nodari Vakhania

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Abstract: Discrete (combinatorial) optimization problems are of a significant practical interest. A set of constraints specify feasible solutions, while a solution which minimizes (maximizes) the given objective function is an optimal one. Typically, we are looking for an optimal or near to the optimal feasible solution. The set of the feasible solutions is always finite, thus there is no major difficulty from the mathematical point of view: we just need to generate all the feasible solutions determining one with the minimal (maximal) value of the objective function. But this might be practically impossible when the number of feasible solutions grows exponentially with the length of the input.

Scheduling problems, with which we deal in this talk, constitute a part of the combinatorial optimization problems. They deal with a finite set of requests (usually called tasks or jobs) which have to be performed on a finite set of resources (usually called machines or processors). A job in a factory or a program in a computer system or a lesson in a school are examples of requests. A machine in a factory or a processor in a computer system or a teacher in a school are examples of resources. Each request has its processing requirement, i.e., it needs a prescribed time on a resource, and usually a resource cannot handle more than one request at a time (for example, a teacher cannot give two lessons simultaneously). Besides, there are a limited number of resources and time is also limited, so that we need to arrange an order in which the requests are handled by the resources to make the total elapsed time as small as possible. We may have different time objective functions (usually non-decreasing), which we wish to minimize or maximize. We may also have some additional restrictions on the orderings which we admit (for example, some lessons should be given before the others). Although the number of all possible admissible orderings or the feasible solutions is finite, it might be extremely large.

In this talk we will discuss a method that permits to construct efficient direct combinatorial polynomial-time algorithms for a class of scheduling problems in which the jobs are released (become available) at different time moments, whereas we wish to complete each job by a specified time moment, the so-called due-date. Our objective is to minimize a non-decreasing (time) objective function. Using this method, we were able to improve a number of existing algorithm and have solved some earlier open problems. The method classifies jobs into exible and rigid ones. Intuitively, the exible jobs are free to be moved easily without becoming late, whereas the movement of the rigid jobs is quite restricted. We show that the exible jobs need to be distributed in between the rigid ones in a way that uses the space in-between different sequences of rigid jobs in some optimal manner. In this way versions of a better known bin packing problem arise. Our algorithms use different strategy for finding such an optimal job partition. Some of them construct it iteratively: a new schedule, associated with a node in a search tree, is generated at each iteration. These schedules are derived from the neighborhood which we define. In other algorithms, finding the above partition is considered as an independent auxiliary problem.

Brief Biography of the Speaker:

Nodari Vakhania is a titular professor at the Science Faculty, the State University of Morelos, Mexico and at the Institute of Computational Mathematics of the Georgian Academy of Sciences. He has received his Ph.D. degree in mathematical cybernetics at the Russian Academy of Sciences, Moscow in 1991, and the doctoral degree in mathematical cybernetics at the Georgian Academy of Sciences, Tbilisi in 2004. His main research interests include design and analysis of algorithms, computational complexity and scheduling theory. He is an author of over 50 research papers. His articles were published in Journal of Algorithms, Journal of Combinatorial Optimization, Journal of Scheduling, Journal of Computer and System Sciences, Annals of Operations Research, Operations Research Letters, Naval Research Logistics and other high-ranked international journals. Professor Vakhania has been worked in different scientific committees including those at Mexican Science Foundation CONACyT. He has been a referee of Journal of Algorithms, Journal of Scheduling, Information Processing Letters, OMEGA, Computers & Operations Research, Operations Research Letters and other journals. He has obtained research grants in Germany, France, The Netherlands, USA, Russia and Mexico and had over 40 invited talks in different countries.

Plenary Lecture 7

Improving Dictionary Based Data Compression by Using Previous Knowledge and Interaction



Professor Bruno Carpentieri

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Abstract: Data Compression is crucial for the transmission and storage of digital data.

The theoretical background of the data compression techniques is strong and well established.

It dates back to the seminal work of Shannon who, more than half a century ago, gave precise limits on the performance of any lossless compression algorithm: this limit is the entropy of the source we want to compress.

Today state of the art lossless compressors are efficient. While it is not possible to prove that they always achieve the entropy limit, their effective performances for specific types of data, like text or continuous images, are very close to this limit.

One option we have to increase compression is to use the knowledge of similar messages from the same source that the two transmitting sides have compressed in the past and to design algorithms that efficiently compress and decompress given this previous knowledge.

By doing this in the fundamental source coding theorem we can substitute entropy with conditional entropy and we have a new theoretical limit that allows for better compression.

Moreover, if we assume the possibility of interaction between the compressor and the decompressor then we can exploit the previous knowledge they both have of the source. The price we might accept to pay is a very low possibility of communication errors.

In this talk we review recent work that applies previous knowledge and interactive approaches to data compression and discuss this possibility.

Brief Biography of the Speaker:

Bruno Carpentieri received the "Laurea" degree in Computer Science from the University of Salerno, Salerno, Italy, and the M.A. and Ph.D. degrees in Computer Science from the Brandeis University, Waltham, MA, U.S.A..

Since 1991, he has been first Assistant Professor and then Associate Professor of Computer Science at the University of Salerno (Italy).

His research interests include lossless and lossy image compression, video compression and motion estimation, information hiding.

He has been, from 2002 to 2008, Associate editor of the journal IEEE Trans. on Image Processing, he was co-chair of the International Conference on Compression and Complexity of Sequences, and, for many years, program committee member of the IEEE Data Compression Conference.

He has been responsible for various European Commission contracts regarding image and video compression.

Plenary Lecture 8

Generalized Differential-Difference Equations to Economic Dynamics and Control



Professor Andre A. Keller

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Abstract: Dynamic economic models generally consists in difference or differential behavioral equations. Several arguments are in favor of continuous time systems: the multiplicity of decisions overlapping in time, a more adequate formulation of market adjustments and distributed lag processes, the properties of estimators, etc. The type of dynamic equations also refer to historical and practical reasons. In some cases of the economic dynamics, delay differential equations (DDEs) may be more suitable to a wide range of economic models. The dynamics of the early Kalecki's business cycle model is represented by a linear first-order DDE with constant coefficients, in the capital stock. Such a DDE, with constant or flexible lags, also occurs in the continuous time Solow's vintage capital growth model. This is due to the heterogeneity of goods and assets. In some qualitative study, the time delay is replaced by the Taylor series for a sufficiently small delay and a not too large higher-order derivative. DDEs with constant lags may be preferably solved by using Laplace transforms. Numerous techniques are also proposed for the solutions of DDEs, like the inverse scattering method, the Jacobian elliptic function method, numerical techniques, the differential transform method, etc. This study uses a block diagram approach with help of the software MATHEMATICA 6.0., and its specialized packages for signal processing, such as the "Control System Professional".

Brief Biography of the Speaker:

At present, Professor Andre A. Keller (66) is an associate researcher in mathematical economics with application to environment problems and related modeling techniques at the CLERS/E a research unit of the French Centre National de la Recherche Scientifique (CNRS) at the University Lille 1, for Sciences and Technologies. Prof. Keller received his PhD in Economics (Operations Research) in 1977 from the Universite de Paris. He taught applied mathematics (linear and nonlinear optimization techniques) and econometrics, microeconomics, theory of games and dynamic macroeconomic analysis. Since 1970, he has been chief econometrician at the Centre d'Observation Economique of the Chamber of Commerce & Industry of Paris. His experience includes macroeconomic, regional studies and commercial statistics: building econometric systems for short run analysis, analyzing policy impacts and forecasting, monthly time-series treatments. At the same time, he contributed to teaching microeconomics with the Universite de Paris. Since 1980, he has been Associate Professor at the Universite de Paris and Researcher in a research unit of the CNRS. His experience centers are on building and analyzing large scale macro-econometric models, as well as forecasting. Since 1985, his research interest has concentrated on high frequency time-series modeling with application to the foreign exchange market : spectral properties of usual filters, automatic selection of ARIMA models, efficiency tests. Since 1990, Prof. Keller's research is centered on discrete mathematics (graph theory), stochastic differential games and tournaments, circuit theory of systems, dynamics and optimal control in economic modeling under uncertainties and in a fuzzy environment. Prof. Andre A. Keller's publications consist in writing articles and co-authoring books. The articles in scientific reviews are on model building with application to macroeconomics and international finance. The books chapters are on semi-reduced forms of econometric models (Martinus Nijhoff, 1984), econometrics of technical change (Springer and IIASA, 1989), advanced time-series analysis (Woodhead- Faulkner), circuits enumeration in digraphs (Springer, 2008), stochastic differential games (Nova Science, 2009), optimal fuzzy control (InTech, 2009), circuit analysis (Nova Science, forthcoming 2010).

Plenary Lecture 9

An Algorithm for the Network Design Problem Based on the Maximum Entropy Method



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Abstract: Network design problem is a well known NP-hard problem which involves topology selection (subset of possible links), routing determination (paths for the offered traffic) and possibly capacity assignment. The goal is to minimize the cost, which can be a combination of the link costs and delay penalties, under possible additional constraints. Network design and analysis almost always involve underdetermined systems, especially when routing policy has to be determined. The maximum entropy method (MEM) is a relatively new technique for solving underdetermined systems which has been successfully applied in many different areas. It is intuitively clear that an optimal network should not have overloaded or underutilized links. The maximum entropy constraint favors uniform distribution and gives a starting topology and routing with smoothly distributed traffic that is expected to be close to the optimal solution. We adjusted the network design problem, primarily the routing feasibility, to the maximum entropy method requirements. Computationally feasible algorithm is developed which implements the standard maximum entropy method, includes adjustments for problems that do not involve probabilities initially, calculates a function that substitutes large sparse matrix, includes heuristic that speeds up calculations by avoiding to invert Jacobian matrix at each iteration, determines variables that define constraints for the routing feasibility, includes additional constraints that direct uniformity of the solution in the desirable direction, cancels opposing traffic and excludes underutilized links. Mentioned additional constraints are “soft”, which is a unique feature of this algorithm, in the sense that they do not have to be satisfied; the solution will be pulled in the direction of satisfying them as much as possible. Some theoretical results are also established that direct initial approximation. Proposed algorithm computes a reasonable solution that is robust with respect to often required dynamic changes of the cost function. The maximum entropy solution can be a good starting point for further optimization considering that the cost function may include delay penalties which involve queuing theory that is usually computationally expensive.

Brief Biography of the Speaker:

Milan Tuba received B. S. in Mathematics, M. S. in Mathematics, M. S. in Computer Science, M. Ph. in Computer Science, Ph. D. in Computer Science from University of Belgrade and New York University. From 1983 to 1987 he was a graduate student and teaching and research assistant at Vanderbilt University in Nashville and Courant Institute of Mathematical Sciences, New York University. From 1987 to 1993 he was Assistant Professor of Electrical Engineering at Cooper Union Graduate School of Engineering, New York. During that time he was the founder and director of Microprocessor Lab and VLSI Lab, leader of scientific projects and supervisor of many theses. From 1994 he was Associate professor of Computer Science and Director of Computer Center at University of Belgrade, Faculty of Mathematics, and from 2004 also Professor of Computer Science and Dean of the College of Computer Science, Megatrend University Belgrade. He was teaching more than 20 graduate and undergraduate courses, from VLSI Design and Computer Architecture to Computer Networks, Operating Systems, Image Processing, Calculus and Queuing Theory. His research interest includes mathematical, queuing theory and heuristic optimizations applied to computer networks, image processing and combinatorial problems. He is the author of more than 70 scientific papers and a monograph. He is coeditor or member of the editorial board or scientific committee of number of scientific journals and conferences. Member of the ACM since 1983, IEEE 1984, AMS 1995, New York Academy of Sciences 1987. Participated in many WSEAS Conferences with plenary lectures and articles in Proceedings and Transactions.

Plenary Lecture 10

Degree of Approximation of Certain Classes of Functions by Positive Linear Operators



Professor Syed Huoorul Hasnain Khan

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Abstract: "Each continuous function is approximable by algebraic polynomials". The most constructive proof of the above theorem concerning the approximation of continuous functions on a compact interval by polynomials, we use some sequence of positive linear operators. It can be mentioned that the more usual tools of Analysis like the Taylor's polynomials and Lagrange's interpolation are not appropriate to the problem of Uniform Approximation of continuous functions. The degree of approximation of positive linear operators by certain classes of functions is considered as the classical problem. The main purpose of the talk is to discuss the problem for the degree of approximation of certain classes of functions using Summability sums as the positive linear operators.

Brief Biography of the Speaker:

Prof. Syed Huoorul Hasnain Khan is a Professor of Mathematics, Department of Mathematics AMU Aligarh India since 1998. Prof. Khan has thirty six years of teaching and research experience and successfully guided students for Ph.D. He has published twenty six research papers in various Journals of International repute and is the author of eight books for undergraduate as well as postgraduate programs which are recommended as text books in many Indian Universities. He is the reviewer for Mathematical Reviews and Zentrblatt fur Mathematik und ihre Grenzgebete. Life member of many Mathematical Societies in India and abroad, President Asian Mathematical Ecological Society (ICTP, ITALY 1996-1999) and the Chairman Department of Mathematics AMU Aligarh India (2006-2009).

Plenary Lecture 11

Dynamic Game Theory and Models of International Macroeconomic Policy



Professor Reinhard Neck

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Abstract: In this paper, we provide a survey of dynamic game theory with special emphasis on past and possible future applications to problems of international economic policy making, where we will concentrate on macroeconomic and stabilization policy problems. First, the paper gives a brief introduction to the theory of dynamic games as developed mostly by mathematicians and control engineers. Dynamic game theory may be regarded as a predecessor and at the same time a substantial extension of the framework of optimum control theory. Next, we will show that dynamic game theory has already been proved to allow important insights into problems of economics, in particular economic policy. Although the number and quality of studies applying the theory of dynamic games are already impressive, we identify some areas where the potential for using dynamic game theory is still not fully utilized. Strangely, the importance of the analytical tools of dynamic game theory for the theory of economic policy is largely neglected just by economists dealing with some problems and results that have been originally developed by mathematicians and control engineers. The topic of time-inconsistency is a case in point for a successful application of dynamic game theory that – although of enormous influence on the theory and practice of economic policy – went largely unnoticed as a particular application of dynamic game theory by the economics profession. Drawing on the author's research, the paper shows how the theory of dynamic games can be applied to problems of economic policy-making with heterogeneous policy-makers whose behavior is characterized by strategic interactions. In particular, for the case of macroeconomic policy-making in a monetary union, strategic interactions between governments of the union's member countries responsible for national fiscal policies and the common central bank responsible for the union's monetary policy can be studied in a fruitful way, using concepts and results from dynamic game theory as applied to a macroeconomic model. It is investigated how policies with and without self-commitment on the one hand and non-cooperative and cooperative policies on the other differ with respect to their reactions on a macroeconomic external shock. Finally, some reasons for many economists' reservations towards dynamic game theory are identified, and suggestions for a strategy towards a fruitful collaboration between mathematicians and economists in this field are given.

Brief Biography of the Speaker:

Reinhard Neck was born in 1951 in Vienna, Austria. He received a PhD in statistics and economics from the University of Vienna and the habilitation from the Vienna University of Economics and Business Administration. He was assistant professor at the University of Fribourg, Switzerland and the Vienna University of Economics and Business Administration, Schumpeter Research Fellow at Harvard University, Cambridge, MA, USA, Full Professor of Economics at the Universities of Bielefeld and Osnabruck, Germany, and Austrian Visiting Professor at Stanford University, Stanford, CA, USA. Since 1997, he is Full Professor at the Department of Economics, Klagenfurt University, Klagenfurt, Austria, where he is now Head of Department. 2007 and 2008, he was President of the Austrian Economic Association. Neck has edited and co-authored about 30 books and authored or co-authored about 270 papers in scientific journals and collective volumes.

Plenary Lecture 12

Outlier Detection for Level Change (LC) in GARCH(1,1) Processes



Professor Azami Zaharim

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Abstract: This study describes outlier detection in time series data for the outlier of level change (LC) type. The main objective is to derive a test statistic for detecting LC in GARCH(1,1) processes. Subsequently a procedure for testing the presence of outliers using the statistics was developed. In the derivation of the statistics, the method applied was based on an analogy of GARCH(1,1) as being equivalent to ARMA(1,1) for the residuals. Because of the difficulty in determining the sampling distributions of the outlier detection statistics, critical regions were estimated through simulations. The performance of the outlier detection was evaluated based on the outlier test criteria using simulations. Results on the power of correctly detecting the outlier was reported. The developed outlier detection procedure was applied for testing the presence of LC outliers in the daily observations of the Kuala Lumpur Composite Index (KLCI), the Index of Consumer Product (ICP), and the Index of Industrial Product (IIP) for the period 1990 to 2005. Over the period, the results indicate that LC outlier occurred in year 1998.

Brief Biography of the Speaker:

Azami Zaharim worked first 13 years as a lecturer in the Universiti Teknologi MARA (University of MARA Technology - UiTM) before joining the Universiti Kebangsaan Malaysia (National University of Malaysia - UKM) in the year 2003. He is Associate Professor at the Faculty of Engineering and Built Environment UKM, and is currently the head for centre engineering education research. He obtained his BSc(Statistics and Computing) with Honours from North London University, UK in 1988 and PhD (Statistics) in 1996 from University of Newcastle Upon Tyne, UK. He specialize in statistics, public opinion, engineering education and renewable energy resources. He has until now published over 100 research papers in Journals and conferences, conducted more than 15 public opinion consultancies and delivered 3 keynotes/invited speeches at national and international meetings. He is currently the head of Renewable Energy Resources and Social Impact Research Group under the Solar Energy Research Institute (SERI). In the year 2007, he headed the Engineering Mathematics Research Group.

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