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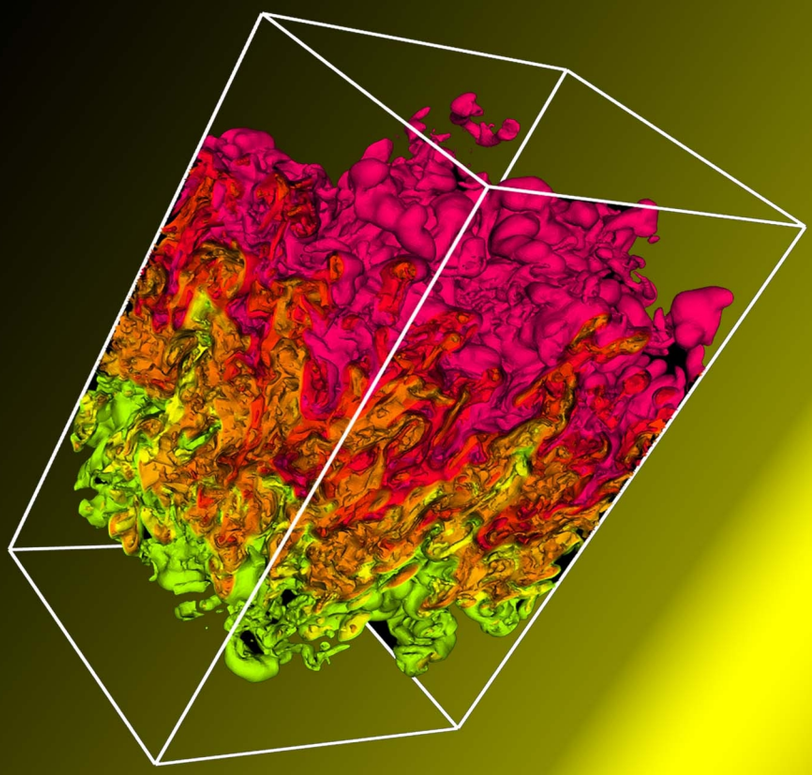
Imre J. Rudas

Recent Advances on Applied Mathematics

Proceedings of the 20th International Conference on Applied Mathematics (AMATH '15)



Budapest, Hungary, December 12-14, 2015

Recent Advances on Applied Mathematics

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Preface

This year the 20th International Conference on Applied Mathematics (AMATH '15) was held in Budapest, Hungary, December 12-14, 2015. The conference provided 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 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 sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences 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

Table of Contents

Plenary Lecture 1: On Fuzzy Change-Point Algorithms for Regression Models 11
Miin-Shen Yang

Plenary Lecture 2: Remarks on the Foundation of Quantum Information Systems 12
Gregory L. Light

Plenary Lecture 3: Multi-Agent Linear Systems with Noise. Solving Decoupling Problem 13
Maria Isabel Garcia-Planas

Structural Controllability and Observability of Switched Linear Systems 15
M. Isabel Garcia-Planas, M. Dolors Magret

Stochastic Volatility and Returns Distributions of the Prague Stock Exchange Index 22
Jan Gogola, Ondrej Slavicek

Statistics of η-μ Random Variable 30
Dragana Krstic, Radmila Gerov, Srdjan Milosavljevic, Goran Petkovic

Multi-Agent Linear Systems with Noise. Solving Decoupling Problem 37
M. Isabel Garcia-Planas

Systems Analysis and Modelling Techniques in Physical Domains 45
Monica Dadamo, Lucas D'Alessandro, Alicia Tinnirello, Eduardo Gago

Risk-Based Approach of Human Reliability in Sociotechnical Systems 52
Gabriela Tont, Dan George Tont

Combinatorial Structures to Represent Simple Games 58
Xavier Molinero

Clifford Algebra with Mathematica 64
J. L. Aragon, G. Aragon-Camarasa, G. Aragon-Gonzalez, M. A. Rodriguez-Andrade

Multidimensional Comparison of Histograms 74
S. I. Bityukov, N. V. Krasnikov, A. V. Maksimushkina, V. V. Smirnova

Optimising Reformed Dynamic Plant Layout Problems via Improved Harmony Search Algorithm 79
Pongchanun Luangpaiboon

Matrices Unitarily Similar to Symmetric Matrices 86
Mao-Ting Chien, Hiroshi Nakazato

Numerical Analysis of the Nonlinear SDEs 92
Vitaliy Lukinov

On a Bivariate Functional Equation Arising from Two Processors 101
El-Sayed El-Hady, Wolfgang Forg-Rob, Janusz Brzdek, Hamed Nassar

A Symmetry Exploration of the Continuous Medical Implant Model derived from Two-Dimensional Discrete Cases 108
Conny Adams, Jacob Manale

Homogenization of a Non Standard Transmission Problem 118
Abdelhamid Ainouz

On Analytical Solutions to the Third Grade Non-Newtonian Steady Fluid Flow Model in a Porous Half-Space through Modified Symmetries and Extended Variation of Parameters 122
Jacob Manale

On a Functional Equation Arising from a Queueing Model 131
El-Sayed El-Hady, Wolfgang Forg-Rob, Janusz Brzdek, Hamed Nassar

Solving a Viral Dynamics Model through Symmetry 139
Andrew Mochaki, Jacob Manale

Modelling and Resolution of a Linear Problem in Integer Numbers for an Optimal Air Hub Location in the WAEMU Zone 144
N'dogotar Nelio, Salimata Gueye Diagne, Abdouramane Gueye

Applications of Probabilistic Distribution via Hurwitz-Radon Matrices 149
Dariusz Jacek Jakobczak

Authors Index 153

Plenary Lecture 1

On Fuzzy Change-Point Algorithms for Regression Models

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Abstract: Change-point (CP) regression models have been widely applied in various fields where detecting change-points (CPs) is an important problem. Detecting the location of CPs in regression models could be equivalent to partitioning data points into clusters of similar individuals. In the literature, fuzzy clustering has been widely applied in various fields, but it is less used in locating CPs in CP regression models. In this paper a new method, called fuzzy CP (FCP) algorithm, is proposed to detect the CPs and simultaneously estimate the parameters of regression models. The fuzzy c-partitions concept is first embedded into the CP regression models. Any possible collection of all CPs is considered as a partitioning of data with a fuzzy membership. We then transfer these memberships into the pseudo memberships of data points belonging to each individual cluster, and so we can obtain the estimates for model parameters by the fuzzy c-regressions method. Subsequently, we use the fuzzy c-means clustering to obtain the new iterates of the CPs collection memberships by minimizing an objective function concerning the deviations between the predicted response values and data values. We illustrate the new approach with several numerical examples and real data sets. Experimental results actually show that the proposed FCP is an effective and useful CP detection algorithm for CP regression models, and can be applied to various fields, such as econometrics, medicine, quality control, and signal processing.

Brief Biography of the Speaker: Prof. Miin-Shen Yang received the BS degree in mathematics from the Chung Yuan Christian University, Chung-Li, Taiwan, in 1977, the MS degree in applied mathematics from the National Chiao-Tung University, Hsinchu, Taiwan, in 1980, and the PhD degree in statistics from the University of South Carolina, Columbia, USA, in 1989.

In 1989, he joined the faculty of the Department of Mathematics in the Chung Yuan Christian University (CYCU) as an Associate Professor, where, since 1994, he has been a Professor. From 1997 to 1998, he was a Visiting Professor with the Department of Industrial Engineering, University of Washington, Seattle. During 2001-2005, he was the Chairman of the Department of Applied Mathematics in CYCU. Since 2012, he has been a Distinguished Professor of the Department of Applied Mathematics and the Director of Chaplain's Office in CYCU. His research interests include fuzzy clustering, applications of statistics, neural fuzzy systems, pattern recognition, and machine learning.

Dr. Yang was an Associate Editor of the IEEE Transactions on Fuzzy Systems (2005-2011), and is an Associate Editor of the Applied Computational Intelligence & Soft Computing and Editor-in-Chief of Advances in Computational Research. He was awarded with 2008 Outstanding Associate Editor of IEEE Transactions on Fuzzy Systems, IEEE; 2009 Outstanding Research Professor of Chung Yuan Christian University; 2010 Top Cited Article Award 2005-2010, Pattern Recognition Letters; 2012-2018 Distinguished Professor of Chung Yuan Christian University; 2013-2015 overseas academic scholar for The 111 Plan of China.

Plenary Lecture 2

Remarks on the Foundation of Quantum Information Systems

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Abstract: Quantum information systems are based on Pauli spin matrices, predicting probabilities. We generalize Pauli matrices in two ways: [1] (a + bi) and (a - bi) instead of just i and -i in the matrix labeled as sigma y, and [2] rank 3 instead of 2, i.e., into 3 x 3 matrices. Accordingly, all (anti) particles, fermions and bosons alike, are derived from the mass-shell equation by colliding electromagnetic waves in a variety of osculating angles with pair-productions of particle-waves spinning along two semi-circles pausing at the osculating angles, manifesting as rest masses and electric charges with 90o for electrons and positrons, 60o for (anti) up-quarks, 30o for (anti) down-quarks, and 0o for (anti) neutrinos (so only left-handed). The (position) wavefunction of a particle is the magnitude of the electric field of the spinning wave existing in the invisible universe of electromagnetic wave energies of a diagonal spacetime 4-manifold, with infinite probability density at the center of the two spinning circles where the particle appears in the visible universe of particles. As we increase the rank of Pauli matrices, we simultaneously reduce the dimensionality of Dirac spinors from 4 to 1, as described by three alternative frames. As such, we cast doubt on the utilities of the gamma matrices in the Standard Model; in this connection, we have also carefully studied the Lagrangian therein and found that the product of the Maxwell field curvature tensor F with its Hodge dual, while yielding the desired energy densities of electromagnetic waves, does not logically imply the ad hoc factorization of the product into one matrix composed of the needed electric field with the magnetic field to account for electromagnetism and the other matrix with the electric field divided by c2 . While an electron can generate electromagnetic waves, the converse is not true. While the electric field and the magnetic field are symmetric in electromagnetic waves, they are not in electromagnetism with one being radial and the other, sideways. We note that suppressing physical constants and inattention to units can lead to mistakes, e.g., the Ampere's law. Otherwise, based on our combined spacetime 4-manifold, we give a simple proof of the CPT theorem and an explanation of the baryon asymmetry. On the whole, our theory presents a local spacetime geometry of (t + it, x + iy, y + iz, z + ix), which can actually be discerned from the pair of equations for the probability amplitudes of the two spin states of an electron in a magnetic field, with a calendar time t to cover a clock time (it) and a spatial distance (x2 + y2 + z2)1/2 to cover the circumference of this imaginary clock. With this perspective, quantum computing should derive benefit from the quotient-space topology of the wave universe.

Brief Biography of the Speaker: Dr. Gregory L. Light is a Professor of Finance of Providence College (PC), where he has been teaching Statistics, Operations Research, among other quantitative subjects. Passionate in his subjects and caring for his students, he was nominated for the 2005 - 2006 Joseph R. Accinno Faculty Teaching Award by the PC Students Congress. Equally engaged in has been his collaborative scholarly activities with his colleagues, opening new research avenues mutually. Dr. Light received his B.A. in Economics from National Taiwan University, M.B.A. from University of Illinois, Ph.D. in Business Economics and Public Policy from University of Michigan, followed by an M.A. in Mathematics by staying at UM-Ann Arbor and then a Ph.D.-ABD in Applied Mathematics from Brown University. The dual tracks of his pursuits evolved from his interests in Mathematical Economics, Dynamical Systems and Physics. In Economics, he has proposed the analytic methodology of “relative derivatives” as an integration of elasticities in Economics with derivatives in Mathematics. In Physics, he has recently connected his “combined spacetime four-manifold” with the Standard Model. He plans to continue his interest in mathematical modeling, extending his research and enriching his teaching.

Plenary Lecture 3

Multi-Agent Linear Systems with Noise. Solving Decoupling Problem

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Abstract: Dynamical multi-agent systems are being extensively studied by researchers in the field of control theory. It is due to the multi-agents appear in different study subjects as for example in the consensus problem of communication networks, formation control of mobile robots or cooperative control of unmanned aerial vehicles.The disturbance decoupling problem for linear dynamical systems with noise was the starting point for the development of a geometric approach to systems theory. The problem consists in that the disturbance not interfere with the solution of the linear dynamical system; in other words, to find a compensator such that the closed loop transfer matrix from disturbance to output is 0. Several multiagents linear systems are affected by noises, nevertheless almost all the existing results in consensus problem, do not take into account the effects of these noises. The goal of this paper is to advance in the study of the consensus problems under noise disturbances using linear algebra techniques.

Brief Biography of the Speaker: Professor Dr. Maria Isabel Garcia-Planas joined the Department of Applied Mathematics at the “Universitat Politecnica de Catalunya” Barcelona, Spain in 1981. Her work had been centered on Linear Algebra, Systems and Control Theory. She has authored over a hundred papers and serves on the referee on several scientific journals. She has been plenary Speaker in several WSEAS International Multi-Conferences as well to Euroment.