



## Editors

Dalibor Biolek

Heimo Walter

Ilie Utu

Christian von Lucken



# Mathematical Methods and Optimization Techniques in Engineering

- Proceedings of the 1<sup>st</sup> International Conference on Optimization Techniques in Engineering (OTENG '13)
- Proceedings of the 1<sup>st</sup> International Conference on Machine Design and Automation (MACDA '13)
- Proceedings of the 1<sup>st</sup> International Conference on Electronics Design and Manufacturing Technology (EDMT '13)

Antalya, Turkey, October 8-10, 2013

## Scientific Sponsors



ISBN: 978-960-474-339-1



# **MATHEMATICAL METHODS and OPTIMIZATION TECHNIQUES in ENGINEERING**

**Proceedings of the 1st International Conference on Optimization Techniques in  
Engineering (OTENG '13)**

**Proceedings of the 1st International Conference on Machine Design and  
Automation (MACDA '13)**

**Proceedings of the 1st International Conference on Electronics Design and  
Manufacturing Technology (EDMT '13)**

**Antalya, Turkey  
October 8-10, 2013**

**Scientific Sponsors:**



Selcuk University in  
Konya, Turkey



Istanbul Technical  
University, Turkey



Faculty of Civil  
Engineering  
Politehnica  
University of  
Timisoara, Romania



University of Petroșani, Romania



Faculty of Geodesy  
Technical University  
of Civil Engineering  
of Bucharest,  
Romania

# **MATHEMATICAL METHODS and OPTIMIZATION TECHNIQUES in ENGINEERING**

**Proceedings of the 1st International Conference on Optimization Techniques in  
Engineering (OTENG '13)**

**Proceedings of the 1st International Conference on Machine Design and  
Automation (MACDA '13)**

**Proceedings of the 1st International Conference on Electronics Design and  
Manufacturing Technology (EDMT '13)**

**Antalya, Turkey  
October 8-10, 2013**

Published by WSEAS Press  
[www.wseas.org](http://www.wseas.org)

**Copyright © 2013, by WSEAS Press**

All the copyright of the present book belongs to the World Scientific and Engineering Academy and Society Press. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Editor of World Scientific and Engineering Academy and Society Press.

All papers of the present volume were peer reviewed by no less than two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.  
See also: <http://www.worldses.org/review/index.html>

ISBN: 978-960-474-339-1

# **MATHEMATICAL METHODS and OPTIMIZATION TECHNIQUES in ENGINEERING**

**Proceedings of the 1st International Conference on Optimization Techniques in  
Engineering (OTENG '13)**

**Proceedings of the 1st International Conference on Machine Design and  
Automation (MACDA '13)**

**Proceedings of the 1st International Conference on Electronics Design and  
Manufacturing Technology (EDMT '13)**

**Antalya, Turkey  
October 8-10, 2013**





**Editor:**

Prof. Dalibor Biolek, University of Defence Brno, Czech Republic  
Prof. Heimo Walter, Vienna University of Technology, Austria  
Prof. Ilie Utu, University of Petrosani, Romania  
Prof. Christian von Lucken, Universidad Nacional de Asunción, Paraguay

**Reviewers:**

Badrul Aisham Md Zin	Libor Pekar
U. C. Jha	Rawid Banchuin
Hamidreza Hoshyarmanesh	El Oualkadi Ahmed
Md. Haider Ali Biswas	Alina Adriana Minea
Michael H. Schwarz	Mahesh Chavan
Yee Jiun Yap	Constantin Popescu
Snezhana Georgieva Gocheva-Ilieva	Christos Volos
Amirhossein Fereidounatabar	Bahaa Kazem
Aron Poanta	Kanwarjit Singh Sandhu
Kevin Kam Fung Yuen	Mehmet Emir Köksal
Dan Florentin Lascu	Ahmed N. Abdalla
Diego Pinto Roa	Jenica Ileana Corcau
Hongjun Liu	Amjad Mahmood
Inácio Fonseca	Mueen Uddin Awan
Jacek Kolodziej	Claudia-Georgeta Carstea
Vignesh Subbian	Hakan Tozan
Ragab Abdulaziz El Sehiemy	Ionel Botef
Guoxiang Liu	Elena Mereuta
Vipul Arvindbhai Shah	Satishkumar Satish Kumar Duraiswamy
Diariy R. Sulaiman	Harjit Pal Singh
Eleazar Jimenez Serrano	Jan Ochodnický
Jiri Hrebíček	Lubnen Moussi
Arvind Dhingra	Mohammad Firoj Mithani
Dhananjay Singh	Dr Kannan K
Hamed Ziaeiipoor	Gabriel Frumusanu
Hime Aguiar	Murugan Paramasivam
Ming-Shen Jian	Mihai Timis
Cristian Fosalau	Chellali Benachaiba
Joao Carmo	Oguz Arslan
Mohamed Hussein	Baburao Kodavati
Ioan Enescu	Kamran Mohajeri
Ioana Adrian	Sorin Ioan Deaconu
Humberto Varum	Kemal Tutuncu
Ismail Yusuf	Bhagwati Prasad
Nikos Loukeris	Humar Kahramanli
Yi-Chao Wu	José Ignacio Hernández López
Muhammet Koksall	Emmanuel Lopez-Neri
Brunonas Dekeris	Daniela Cristina Momete
Zanariah Abdul Majid	Gabriella Bogner
Yang Zhang	Zahéra Mekkioui
Yuqing Zhou	Claude Bayeh
Dinko Vukadinovic	Lungu Mihai Aureliu
Kostantinos Kalovrektis	Andrzej Zak
Kamyar Mehranzamir	Liang Zhou
Dana Anderson	Selvaperumal S
Dimitrios Ventzas	Naveen G. Ramunigari
Ahmet Arslan	Dib Karam
Md. Jakir Hossen	Elena Scutelnicu
Rajveer Mittal	Huashui Zhan
Vassos Vassiliou	Al Emran Ismail
Emre Kiyak	Md. Shamim Akhter

Sk. Sarif Hassan  
Haitham Jabbar Taha Haitham  
Ibrahim Canak  
Mohammad Gudarzi  
Alejandro Fuentes-Penna  
Arjuna Marzuki  
Mahdi Faraji  
Alina Badulescu  
Ali Hennache  
David Nicoleta  
Hamideh Eskandari  
Kandarpa Kumar Sarma  
Marius Marcu  
Anca Croitoru  
Katerina Hyniova  
Hari Moha Pandey  
Mokhtari Fouad  
Gherghinescu Sorin

**Preface**

This year the multiconference that consisted of the 1st International Conference on Optimization Techniques in Engineering (OTENG '13), the 1st International Conference on Machine Design and Automation (MACDA '13) and the 1st International Conference on Electronics Design and Manufacturing Technology (EDMT '13) was held in Antalya, Turkey, October 8-10, 2013. The multiconference provided a platform to discuss environment and pollution, sustainable development, water resources management, environmental engineering, pollution and monitoring, geophysics, geology and environmental systems 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 multiconference is 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 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





# Table of Contents

<b><u>Keynote Lecture 1: Energy &amp; Environmental Problems Facing India and Turkey and their Probable Solutions</u></b>	13
<i>D. P. Kothari</i>	
<b><u>Keynote Lecture 2: Confirming the Power of Probabilistic Evolution Approach: A Concrete Application to Get the Analytical Solution</u></b>	14
<i>Metin Demiralp</i>	
<b><u>Plenary Lecture 1: Tropical Optimization: Some Problems, Methods, and Applications</u></b>	16
<i>Nikolai Krivulin</i>	
<b><u>Plenary Lecture 2: On New Visualization Tools, Data Mining Methods and Mathematical Techniques in the Analysis of the Weight Space of Neural Networks Solving Complex Real World Tasks for Pattern Recognition, Control and Function Approximation</u></b>	17
<i>Dimitrios A. Karras</i>	
<b><u>Plenary Lecture 3: Comparison of 2k-Factorial and Taguchi Method for Optimization Approach in 32nm NMOS Device</u></b>	18
<i>Azami Zaharim</i>	
<b><u>Plenary Lecture 4: Exponential Function of a Multivariate Argument within the High Dimensional Model Representation (HDMR) Perspective</u></b>	19
<i>N. A. Baykara</i>	
<b><u>Plenary Lecture 5: Design for a Machine Used for Superfinishing the Internal Surfaces of Gears that Are Components of a Gearbox of a Truck</u></b>	20
<i>Badea Lepadatescu</i>	
<b><u>Plenary Lecture 6: Parametric Design for Adhesive Dispensing Process in Electronics Manufacturing</u></b>	21
<i>Jay (Chien-Yi) Huang</i>	
<b><u>Plenary Lecture 7: Electronic Circuit Design For Ensuring Safety Of Business in Band Systems</u></b>	22
<i>Selcuk Comlekci</i>	
<b><u>Enhanced Multivariate Product Representation Under an Integral Operator Weight with a Product Type Kernel of Univariate Factors</u></b>	23
<i>Zeynep Gundogar, Metin Demiralp</i>	
<b><u>Reducing Harmonic Pollution using the Method of Instantaneous Reactive Power Theory for Control Active Power Filters</u></b>	29
<i>Marius Marcu, Florin-Gabriel Popescu, Leon Pana</i>	
<b><u>Explicit Solution of a Tropical Optimization Problem with Application to Project Scheduling</u></b>	39
<i>Nikolai Krivulin</i>	

<b><u>Piecewise Enhanced Multivariate Products Representation Using Chebyshev Nodes</u></b>	46
<i>Suha Tuna</i>	
<b><u>Optimization of Coat-Hanger Melt Distributors for the Wire Coating Process using Numerical Simulation and Experiments</u></b>	52
<i>Nadhir Lebaal, Sameh Lebbal, Leila Belaggoune, Samuel Gomes</i>	
<b><u>Study and Realisation of a the Three - Level IGBT voltage source PWM Inverter using D.S.P controller (TMS320LF2407)</u></b>	61
<i>H. Denoun, N. Benyahia, M. Zaouia, N. Benamrouche, S. Haddad, S. Ait Mamar</i>	
<b><u>Fluctuation Free Integration in Mobius Transformational High Dimensional Model Representation</u></b>	68
<i>M. Alper Tunga</i>	
<b><u>Implementation of PWM Converters in Drive Mining Extraction Plants</u></b>	72
<i>Ilie Utu</i>	
<b><u>Enhanced Multivariate Products Representation based Scalarization of Integrals Appearing in Solutions of Probabilistic Evolution Equations of Conical ODEs</u></b>	79
<i>Cosar Gozukirmizi</i>	
<b><u>Direct Solutions to Tropical Optimization Problems with Nonlinear Objective Functions and Boundary Constraints</u></b>	86
<i>Nikolai Krivulin, Karel Zimmermann</i>	
<b><u>Automatic Street Light Control System Using Microcontroller</u></b>	92
<i>Mustafa Saad, Abdalhalim Farij, Ahamed Salah, Abdalroof Abdaljalil</i>	
<b><u>Emergency Public Service System Design Using IP-Solver</u></b>	97
<i>Jaroslav Janacek</i>	
<b><u>Efficient Wireless Access Network Design based on Improved Heuristic Optimization Algorithms</u></b>	102
<i>Vasilios Pasias, Dimitrios A. Karras, Rallis C. Papademetriou</i>	
<b><u>Determination of the Stress State of Shells under Local Load</u></b>	109
<i>E. A. Barashkova, I. G. Emelyanov</i>	
<b><u>Numerical Integration of Multivariate Functions by Using Fluctuationlessness Theorem: Generalization</u></b>	114
<i>Ercan Gurvit, N. A. Baykara</i>	
<b><u>Governing the Reductive Flexibilities in the Kronecker Power Representation of Ordinary Differential Equations</u></b>	120
<i>Semra Bayat, Metin Demiralp</i>	
<b><u>Comparison of 2k-Factorial and Taguchi Method for Optimization Approach in 32nm NMOS Device</u></b>	125
<i>F. Salehuddin, K. E. Kaharudin, H. A. Elgomati, I. Ahmad, P. R. Apte, Z. M. Nopiah, A. Zaharim</i>	

<b><u>Microcontroller Controlled Smart Irrigation System Design</u></b>	135
<i>Kadir Sabanci, Murat Koklu, Cevat Aydin</i>	
<b><u>Modeling and Simulation of Welding Robot Trajectory using Catia Software</u></b>	140
<i>Luminița Popa, Simona Sofia Duicu</i>	
<b><u>High Dimensional Model Representation Under an Integral OperatorWeight with a Product Type Kernel of Univariate Factors</u></b>	146
<i>Derya Bodur, Metin Demiralp</i>	
<b><u>Design of Rehabilitation Robot based on Pneumatic Artificial Muscles</u></b>	151
<i>Ondrej Liska, Marcel More, Dagmar Janacova, Hana Charvatova</i>	
<b><u>Integral Representation Varieties for Kronecker Power Series</u></b>	155
<i>Alparslan Pehlivan, Metin Demiralp</i>	
<b><u>Measuring Human Response to a Visual Stimulus Using a Joystick</u></b>	160
<i>Jan Boril, Rudolf Jalovecky</i>	
<b><u>Reciprocal Approximants for Kronecker Power Series</u></b>	166
<i>Melike Ebru Kirkin, Metin Demiralp</i>	
<b><u>Design for a Machine used for Superfinishing the Internal Surfaces of Gears that are Components of a Gearbox of a Truck</u></b>	171
<i>Badea Lepadatescu, Valentin Ditu, Anisor Nedelcu</i>	
<b><u>Mobius Transformational Discrete High Dimensional Model Representation: Binary Hybridization</u></b>	178
<i>Evrin Korkmaz Ozay, Mehmet Alper Tunga</i>	
<b><u>Hydraulic Modeling of Watercourse Aranca in Town Sannicolau Mare, Timis County, Romania</u></b>	183
<i>Robert Florin Beilicci, Erika Beata Maria Beilicci</i>	
<b><u>Reducing Multinomiality into Conicality in Autonomous Explicit Ordinary Differential Equations</u></b>	187
<i>Berfin Kalay, Metin Demiralp</i>	
<b><u>An Influence of the Lengths Distribution in the Distance Matrix on the Efficiency of the Exact p-Median Algorithm</u></b>	192
<i>Marta Janackova, Alzbeta Szendreyova</i>	
<b><u>Mobius Transformational Enhanced Multivariate Product Representation Through Fluctuation Free Integration</u></b>	196
<i>Burcu Tunga</i>	
<b><u>Multivariate Hausdorff Moment Problem Arising From Quantum Mechanical Applications of Probabilistic Evolution Approach</u></b>	201
<i>Muzaffer Ayvaz, Metin Demiralp</i>	

<b><u>Fluctuations in Kronecker Power Series of Quantum Mechanical Operators Under Gaussian Initial Wave Packets</u></b>	206
<i>Bahar Yolcu, Muzaffer Ayvaz</i>	
<b><u>Optimization of Mesh-Partitioning for Reduced-Order Modeling of Thermal Behavior</u></b>	212
<i>Serap Karagol</i>	
<b><u>Mobius Transformational Enhanced Multivariate Product Representation</u></b>	217
<i>Gizem Ozdemir, Burcu Tunga</i>	
<b><u>Matrix Weighted Multivariate Hausdorff Moment Problem Arising From Quantum Mechanical Applications of Probabilistic Evolution Approach</u></b>	222
<i>Muzaffer Ayvaz, Metin Demiralp</i>	
<b><u>Generating Energy Optimal Powertrain Force Trajectories with Dynamic Constraints</u></b>	228
<i>Simon Schmidt, Paolo Mercorelli</i>	
<b><u>Optimization of Block Work Quay Walls Cross Section using SQP Method</u></b>	234
<i>Mehdi Shafieefarand Alireza Mirjalili</i>	
<b><u>Authors Index</u></b>	242

## Keynote Lecture 1

### Energy & Environmental Problems Facing India and Turkey and their Probable Solutions



Dr. D. P. Kothari

Director General, JB Group of Institutions, Hyderabad

Former Director General, RGI, Nagpur

Former Director General, VITS Indore

Former Vice Chancellor, VIT Vellore

Former Director I/c IIT Delhi

India

E-mail: [dpk0710@yahoo.com](mailto:dpk0710@yahoo.com)

**Abstract:** It briefly discusses some important energy problems facing India and Turkey and presents the current electric generation scenario in most of the developing countries with facts and figures in respect of India. It is hoped that, with systematic, advance planning, through measures like co-generation, energy management, and energy conservation, the electric energy supply scenario of AD 2020 will be free of the perennial problems of power shortages, voltage fluctuations etc.

**Brief Biography of the Speaker:** D.P.Kothari is, presently, Director General of J B Group of Institutions ,Hyderabad. He obtained his BE (Electrical) in 1967, ME(Power Systems) in 1969 and Ph.D in 1975 from the Birla Institute of Technology & Science(BITS) Pilani, Rajasthan. Prior to assuming charge as DG, JBI ,Hyderabad, he served as DG RGI , DG VGI, Indore, Vice Chancellor, VIT, Vellore, Director in-charge and Deputy Director (Administration) IIT Delhi as well as Head in the Centre of Energy Studies at Indian Institute of Technology, Delhi and as Principal, Visvesvaraya Regional Engineering College, Nagpur.

He was Visiting Professor at the Royal Melbourne Institute of Technology, Melbourne, Australia, during 1982-83 and 1989 for two years. He was also NSF Fellow at Purdue University, USA in 1992. He is fellow of Indian National Academy of Engineering (INAE), Indian National Science Academy (FNASc), Institution of Engineers, India (IEI) and Institute of Electrical and Electronics Engineers (FIEEE).He has authored /co-authored/more than 725 papers in International/National Journals/Conferences & 30 books including Power System Engineering, 2e Electric Machines, 4e Electric Machines (Sigma Series), 2e and Basic Electrical Engineering, 3e. His fields of specialization are Optimal Hydrothermal Scheduling, Unit Commitment, Maintenance Scheduling, Energy Conservation (loss minimization and voltage control), Power Quality and Energy System Planning and Modeling.

## Keynote Lecture 2

### Confirming the Power of Probabilistic Evolution Approach: A Concrete Application to Get the Analytical Solution



Professor Metin Demiralp  
Istanbul Technical University  
Informatics Institute  
Istanbul, TURKEY  
E-mail: [metin.demiralp@gmail.com](mailto:metin.demiralp@gmail.com)

**Abstract:** The last three years accumulated a great pile of information about the Probabilistic Evolution Approach (PEA) which is under construction in the Group for Science and Methods of Computing (Demiralp's group) studies. Until now, the skeleton and the roof of the theory has been constructed and many details, as if muscles and other organs, have also been revealed. Now we know how to convert a given set of explicit first order ordinary differential equations accompanied by appropriate initial conditions to an infinite first order, linear, homogeneous set of ordinary differential equations with a denumerably infinite constant coefficient matrix; accompanied by a denumerably infinite initial vector value imposition. We could be able also to obtain Kronecker power series solution when the descriptive function (right hand side function) vector has a conical structure. Even we could have been able to get finitely many term involving analytic results for rather specific ODE structures. However we have never intended to perform a resummation over the Kronecker power series obtained in Probabilistic Evolution Approach applications even though the issue has been reduced to kernel separability where the telescope and monocular matrices are in use.

In this presentation first we focus on simplest first order explicit ordinary differential equation and its accompanying initial condition, where the right hand side function does not depend on the independent variable (time variable in the dynamical system terminology) of the considered ODE and has a second degree polynomial structure in the unknown function of the ODE under consideration. If there are certain commutativity relations exist in the descriptive function coefficient matrices then it is possible to produce a matrix algebraic analytic structure for the solution. To this end a very recently developed approach we have called "Constancy Added Space Extension (CASE)" can be used. This extends the state space of the ODE from one dimension to two dimension and makes it possible to get pure quadraticity at the descriptive function. Then, by using certain very fruitful properties of the Kronecker products and powers, it becomes to generate an analytical solution if the coefficient matrix appearing in the quadratic structure of the descriptive function has certain symmetry conditions and also commutativity conditions. The presentation aims to focus on these issues as the time permits.

**Brief Biography of the Speaker:** Metin Demiralp was born in Türkiye (Turkey) on 4 May 1948. His education from elementary school to university was entirely in Turkey. He got his BS, MS degrees and PhD from the same institution, Istanbul Technical University. He was originally chemical engineer, however, through theoretical chemistry, applied mathematics, and computational science years he was mostly working on methodology for computational sciences and he is continuing to do so. He has a group (Group for Science and Methods of Computing) in Informatics Institute of Istanbul Technical University (he is the founder of this institute). He collaborated with the Prof. Herschel A. Rabitz's group at Princeton University (NJ, USA) at summer and winter semester breaks during the period 1985-2003 after his 14 month long postdoctoral visit to the same group in 1979-1980. He was also (and still is) in collaboration with a neuroscience group at the Psychology Department in the University of Michigan at Ann Arbor in last three years (with certain publications in journals and proceedings).

Metin Demiralp has more than 100 papers in well known and prestigious scientific journals, and, more than 230 contributions together with various keynote, plenary, and, tutorial talks to the proceedings of various international conferences. He gave many invited talks in various prestigious scientific meetings and academic institutions. He has a good scientific reputation in his country and he was one of the principal members of Turkish Academy of Sciences since 1994. He has resigned on June 2012 because of the governmental decree changing the structure of the academy and putting political influence possibility by bringing a member assignation system. Metin Demiralp is also a member of European Mathematical Society. He has also two important awards of Turkish scientific establishments.

The important recent foci in research areas of Metin Demiralp can be roughly listed as follows: Probabilistic Evolution Method in Explicit ODE Solutions and in Quantum and Liouville Mechanics, Fluctuation Expansions in Matrix Representations, High Dimensional Model Representations, Space Extension Methods, Data Processing via



Multivariate Analytical Tools, Multivariate Numerical Integration via New Efficient Approaches, Matrix Decompositions, Multiway Array Decompositions, Enhanced Multivariate Product Representations, Quantum Optimal Control.

## Plenary Lecture 1

### Tropical Optimization: Some Problems, Methods, and Applications



Professor Nikolai Krivulin  
Faculty of Mathematics and Mechanics  
St. Petersburg State University  
Russia  
E-mail: [nkk@math.spbu.ru](mailto:nkk@math.spbu.ru)

**Abstract:** We give an overview of multidimensional optimization problems formulated in terms of tropical (idempotent) mathematics, outline related solution methods, and discuss applications. We start with a motivating example and a brief introduction to tropical mathematics to provide an appropriate framework for further discussion. The optimization problems are defined as to minimize linear and nonlinear functionals on finite dimensional semimodules over idempotent semifields, subject to linear inequality and equality constraints. Furthermore, we show that some problems have complete closed-form solutions, whereas solutions for other problems are only known in the form of iterative computational schemes that find a particular solution if any, or indicate its absence. Finally, application examples of real-world problems are considered, which are drawn from project scheduling, location analysis, transportation networks, decision making, and discrete event systems.

**Brief Biography of the Speaker:** Nikolai Krivulin received a university degree in applied mathematics and operations research in 1983 from St. Petersburg State University, St. Petersburg, Russia. He got his Ph.D. degree in 1990 and D.Sc. degree in 2010 both in applied mathematics from the same university. He worked at the Computer Center of St. Petersburg State University from 1983 to 1985, when he started his Ph.D. study. In 1987 he joined the Faculty of Mathematics and Mechanics at the University as an Assistant Professor, became there an Associate Professor in 1991 and a Professor in 2012. From 1999 to 2002 he was the head of the Department of Information Management at the Graduate School of Management of the same university.

He is currently a Professor of the Department of Statistical Modelling at St. Petersburg State University. His research interests include theory and applications of idempotent algebra, modelling and performance evaluation of queueing systems, methods of optimization, computational statistics and computer simulation. He is an author and coauthor of more than 80 publications including papers in reviewed journals and conference proceedings, books chapters, textbooks, and a monograph. He was a grantee of national and international foundations, including the Russian Foundation for Basic Research, the Russian Foundation for Humanities Research, the NATO Science Foundation, the USIA and Eurasia Foundation (USA), and the Royal Society (UK). He served as a member of program and organizing committees of international conferences on mathematics, computer sciences, and information technology. He is a member of the St. Petersburg Mathematical Society, AMS, and SIAM.

## Plenary Lecture 2

### On New Visualization Tools, Data Mining Methods and Mathematical Techniques in the Analysis of the Weight Space of Neural Networks Solving Complex Real World Tasks for Pattern Recognition, Control and Function Approximation



Professor Dimitrios A. Karras  
Dept. Automation, Hellas  
Chalkis Institute of Technology  
Greece  
E-mail: dakarras@ieee.org

**Abstract:** One of the main reasons for the slow convergence and the suboptimal generalization results of MLP Neural Networks (Multilayer Perceptrons) based on gradient descent training is the lack of proper initialization of the weights to be adjusted. Even sophisticated learning procedures are not able to compensate for bad initial values of weights, while good initial guess leads to fast convergence and/or better generalization capability even with simple gradient-based error minimization techniques. Although initial weight space in MLPs seems so critical there is no in depth study so far of its properties with regards to which regions lead to solutions or failures concerning generalization and convergence in real world problems. There exist only some preliminary studies for toy problems, like XOR. Therefore, the topological properties analysis of such Neural Network weight spaces emerges as an important issue. The first major scope of this plenary talk is to present visualization tools and techniques based on a data mining approach, involving suitable Self Organizing Feature Maps (SOFM), in order to demonstrate that a complete analysis of the MLP weight space is possible even in the case of complex real world problems. Moreover, involving the transformed space of Self Organizing Feature Maps, a deterministic chaos approach is employed to quantitatively estimate and explore the transformed weight space revealing critical topological properties.

On the other hand, research attempts on weight initialization in Neural Networks have provided interesting results and led to the development of a number of initialization procedures. In this plenary talk, after a critical overview, we present, as a second major goal, enhanced simple initialization procedures for back-propagation trained Multi Layer Perceptrons that employ nodes with sigmoid activation functions, involving simple algorithmic schemes based on interval arithmetic considerations, remarkably improving previous literature results. Such new efficient schemes based on interval analysis show the value of this important mathematical tool in nonlinear systems, like neural networks, analysis for devising new initialization and training algorithms.

The herein presented visualization tools based on data mining approach involving SOFM, the analysis of SOFM transformed MLPs weight space based on deterministic chaos calculations as well as the rich mathematical methods of interval analysis applied to weight space algorithmic estimation, for improved initialization and training procedures are considered and evaluated in a series of real world benchmarks including pattern recognition, control and function approximation tasks obtaining remarkably promising results.

**Brief Biography of the Speaker:** Dimitrios A. Karras received his Diploma and M.Sc. Degree in Electrical and Electronic Engineering from the National Technical University of Athens, Greece in 1985 and the Ph. Degree in Electrical Engineering, from the National Technical University of Athens, Greece in 1995, with honours. From 1990 and up to 2004 he has collaborated as visiting professor and researcher with several universities and research institutes in Greece. Since 2004, after his election, he has been with the Chalkis Institute of Technology, Automation Dept., Greece as associate professor in Digital Systems and Signal Processing as well as with the Hellenic Open University, Dept. Informatics as a visiting professor in Communication Systems (since 2002 and up to 2010). He has published more than 55 research refereed journal papers in various areas of pattern recognition, image/signal processing and neural networks as well as in bioinformatics and telecommunications and more than 155 research papers in International refereed scientific Conferences. His research interests span the fields of pattern recognition and neural networks, image and signal processing, image and signal systems, biomedical systems, communications, networking and security. He has served as program committee member in many international conferences, as well as program chair and general chair in several international workshops and conferences in the fields of signal, image and automation systems. He is, also, editor in chief of the International Journal in Signal and Imaging Systems Engineering (IJSISE), topics editor in chief of the International Journal of Digital Content Technology and its Applications (JDCTA) as well as associate editor in various scientific journals. He has been cited in more than 500 research papers, his h-index is 10 and his Erdos number is 5.

## Plenary Lecture 3

### Comparison of 2k-Factorial and Taguchi Method for Optimization Approach in 32nm NMOS Device



Professor Azami Zaharim

Head of Project Group of Renewable Energy Resources Analysis,  
Policy & Energy Management, Renewable Energy Niche and  
Head Centre for Engineering Education Research  
Faculty of Engineering and Built Environment  
Universiti Kebangsaan Malaysia  
MALAYSIA

E-mail: [azami.zaharim@gmail.com](mailto:azami.zaharim@gmail.com)

**Abstract:** As silicon is now hit atomic resolution and reaching its physical and electrical limitation, producing a proper working transistor is tended to be harder and complicated. In this research, the effect of the process parameters variation on threshold voltage (VTH) was investigated. The fabrication of the transistor device was performed using TCAD simulator, consisting of ATHENA and ATLAS modules. These two modules were combined with Taguchi method to optimize the process parameters. Initially, the comparison between two different statistical methods which is 2k-factorial designs, and Taguchi Method was being conducted. In this comparison, the effects of the process parameters variation on VTH were studied. The most dominant or significant factors for S/N Ratio are halo implant energy, S/D implant dose and S/D implant energy. Meanwhile, the S/N Ratio values of VTH after the optimization approaches for array L8 is 23.8 dB. In L8 experiments, VTH value for NMOS device after optimizations approaches is +0.247V. The results obtained are closer to ITRS 2011 prediction. As conclusions, Taguchi Method was observed to be the most suitable method to be implemented in statistical modeling of 32nm NMOS device.

**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 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. In the year 2007, he headed the Engineering Mathematics Research Group. At the same time, he is currently active involve in outcome based education (OBE) approach at the national level and the chairman of the Engineering Education Research Group since 2005. He is also involved actively in the research for the future of engineering education in Malaysia 2006 under the Ministry of Higher Education of Malaysia. He is currently Head of Project Group of Renewable Energy Resources Analysis, Policy & Energy Management, Renewable Energy Niche and also Head of Centre for Engineering Education Research. He has until now published over 80 research papers in Journals and conferences, conducted more than 15 public opinion consultancies and delivered 4 keynotes/invited speeches at national and international meetings.

## Plenary Lecture 4

### Exponential Function of a Multivariate Argument within the High Dimensional Model Representation (HDMR) Perspective



Professor N. A. Baykara  
Mathematics Department  
Marmara University  
Istanbul, TURKEY  
E-mail: [nabaykara@gmail.com](mailto:nabaykara@gmail.com)

**Abstract:** Especially last decade brought important developments in the theory of High Dimensional Model Representation (HDMR) which was first proposed by Sobol in 1993. In its first format, HDMR was a function decomposition in ascending multivariate. A given target multivariate function was expressed the sum of a single constant term that is followed by  $N$  number of univariate function component each of which depends on a different but single independent variable and bivariate terms group composed of bivariate functions each of which depends on a different couple of independent variables and so on. Sobol proposed vanishing conditions for HDMR components such that each component except the constant one should vanish if it is integrated between 0 and 1 inclusive with respect to anyone of its arguments. These conditions were sufficient to uniquely determine each HDMR component as long as the target function is integrable in the hypercube whose one corner is located at the origin while its each edge resides in a different axis' positive half.

Herschel Rabitz brought the nonunit weight concept under the product type assumption (it is product of the univariate functions each of which is a weight function depending on a different independent variable) and extended the geometry from unit hypercube to hyperprisms. Demiralp group revealed many important properties of HDMR and developed various effective HDMR versions to increase the truncated HDMR approximants. As state of art developments, factorized, hybrid, transformational HDMR varieties have been arisen while the product type hypothesis has also been relaxed. As a quite recently developed and more enthusiastic approach, "Enhanced Multivariate Product Representation" has shown up in the stage to more delicately control the truncation approximant quality. The further studies are also in the air at the present time. This talk focuses on the univariate exponential functions whose argument is a multivariate function. The argument function has been taken as at most quadratic form structure even though it may be complicated for more rigorous application. What we report here is the application of HDMR in finite dimensional space to this type of functions and to show a rather detailed investigation results together with interpretations.

**Brief Biography of the Speaker:** N. A. BAYKARA was born in Istanbul, Turkey on 29th July 1948. He received a B.Sc. degree in Chemistry from Bosphorous University in 1972. He obtained his PhD from Salford University, Greater Manchester, Lancashire, U.K. in 1977 with a thesis entitled "Studies in Self Consistent Field Molecular Orbital Theory". Between the years 1977–1981 and 1985–1990 he worked as a research scientist in the Applied Maths Department of The Scientific Research Council of Turkey. During the years 1981–1985 he did postdoctoral research in the Chemistry Department of Montreal University, Quebec, Canada. Since 1990 he is employed as a Staff member of Marmara University. He is now a Full Professor of Applied Mathematics mainly teaching Numerical Analysis courses and is involved in HDMR research and is a member of Group for Science and Methods of Computing in Informatics Institute of Istanbul Technical University. Other research interests of his for him are "Density Functional Theory" and "Fluctuationlessness Theorem and its Applications" which he is actually involved in. Most recent of his concerns is focused at efficient remainder calculations of Taylor expansion via Fluctuation-Free Integration, and Fluctuation-Free Expectation Value Dynamics.

## Plenary Lecture 5

### Design for a Machine Used for Superfinishing the Internal Surfaces of Gears that Are Components of a Gearbox of a Truck



Associate Professor Badea Lepadatescu  
Department of Manufacturing Engineering  
Faculty of Technological Engineering and Industrial Management  
Transilvania University of Brasov  
Romania  
E-mail: [lepadatescu@unitbv.ro](mailto:lepadatescu@unitbv.ro)

**Abstract:** In the paper is presented a machine tool that is used to accomplish the surface quality that is required for the internal surfaces of gears that are components of a gear box of a truck. As is known in a gear box of a truck are many gears that are mounted on a needle bearings. For this reason, the internal surfaces of these gears need to have a very high surface quality to work properly. The machine that is presented in the paper was designed to realize the entire requirement regarding the surface quality for all the types and sizes of gears that are in the truck gearbox.

**Brief Biography of the Speaker:** Badea Lepadatescu is currently an Associate Professor at the Faculty of Technological Engineering and Industrial Management of Transilvania University of Brasov, Romania. He obtained his doctoral degree in 1998 in the area of machining through superfinishing process. After he graduated he worked five years as design engineer at Roman truck factory in the field of manufacturing processes where he designed many devices and special machine tools especially for superfinishing process. Started on 1982 he worked as research engineer at Transilvania University of Brasov, and after 1997 he is teaching at Department of Manufacturing Engineering. His main academic interests include Tolerance and Dimensional Control, Manufacturing Engineering Processes, Automation Processes, and Renewable Energy Sources. The research accomplishments are reflected through publications in a five books and authored or co-authored over 120 papers published at international conferences. He has extensive experience in both experimental and theoretical research work having more than 50 contracts with factories to design and produce machine tools for machining processes. Also in the field of Renewable Energy Sources together with a team he made two wind turbines, one with horizontal axis for taking water, and one with vertical axis to produce electric energy. He has been speaker to international conferences, has moderated forums, organized symposia, workshops and sessions at major international conferences.

## Plenary Lecture 6

### Parametric Design for Adhesive Dispensing Process in Electronics Manufacturing



Professor Jay (Chien-Yi) Huang  
Department of Industrial Engineering and Management  
National Taipei University of Technology  
Taiwan ROC

E-mail: [jayhuang@ntut.edu.tw](mailto:jayhuang@ntut.edu.tw)

**Abstract:** Due to increasing environmental consciousness, the European Union has prohibited the use of lead substances in electronics soldering material. 58Bi/42Sn solder with a melting temperature of only 138°C helps achieve a lower process temperature to resolve the board warpage issue. Curing the adhesive simultaneously with solder reflow helps simplify the assembly process and reduces the manufacturing cost. When a low soldering temperature profile is used, the impact on the adhesion performance of the cured adhesive becomes a major concern. This study develops an environmentally conscious adhesive dispensing process. The case study considers a stereo product using the low cost CEM-1 PCB material and select 58Bi/42Sn as solder alloy. Taguchi based experimental design is employed to investigate the influence of process parameters on the shear strength of 0805 chip capacitors under various test conditions. In addition to PCA methodologies, this study also employs TOPSIS method to determine the optimal process scenarios for the multiple quality characteristics.

**Brief Biography of the Speaker:** Chien-Yi Huang received the Ph.D. degree from the State University of New York at Binghamton, Vestal in 1996. He is currently an Associate Professor with the National Taipei University of Technology, Taipei, Taiwan. He was the Head - Chief of Process Technology with Wistron Corporation, and was involved in research on new process technology enabling and materials characterization. His current research interests include process optimization of electronics manufacturing and electronics reliability. He has 20 publications in highly rated ISI journals and 35 in conference proceedings.



## Plenary Lecture 7

### Electronic Circuit Design For Ensuring Safety Of Business in Band Systems



Associate Professor Selcuk Comlekci  
Department of Electronics and Communication Engineering  
Faculty of Engineering  
Suleyman Demirel University  
Turkey  
E-mail: [selcukcomlekci@sdu.edu.tr](mailto:selcukcomlekci@sdu.edu.tr)

**Abstract:** In our developing and changing world increasing the effectiveness and efficiency of factories, it is important to adapt to changes in technology. In parallel to technological changes, security measures are updated in accordance with age. For example, a large number of conveyor belts in factories often used to transport raw materials. Here, as a security measure, only a one band is used to stop along the steel wire. With this type of system used a mechanical protection is not possible to provide complete security. In this study, steel wire standing next to a belt conveyor system was removed and instead of mechanical system, scanning laser system was placed across the entire band system. Thus, the system automatically stops when accident occur, to work whole system again someone must press the reset button or intervention will be required from the automation center. This work; both employees and employers, in terms of prevention is very important to material and moral losses.

**Brief Biography of the Speaker:** Brief Biography of the Speaker: Selcuk Comlekci received his B.S. degree in Electrical Engineering from Hacettepe University, in 1980, and M.Sc. degree from Science Institute of Suleyman Demirel University in 1996 and received his Ph.D. degree in Electrical and Electronics Engineering from Sakarya University, Turkey, in 2002. His research interests are RF Measurement and Instrumentation, Neuro-Fuzzy Applications, Soft Computing Techniques, Electromedical Design, EMI/EMC Applications, and general Biomedical Engineering. From 1982 to 1996, he was a Senior Engineer in Official Duties. Dr. Comlekci is associate professor at Department of Electronics and Communication Engineering, Suleyman Demirel University, Isparta, Turkey. He gives much kind of lectures both for undergraduate and graduate at his department. He is Senior Member of IEEE (2007), URSI, and BIOELECTROMAGNETICS Societies. Also he has current membership in IEEE, EMC Society and EMO (Turkish Chamber of Electrical Engineering). IEEE, ICES (International Committee on Electromagnetic Safety) chose him as a member of ICES TC95 Main Committee in 2008. He is the third member from Turkey in this committee. He is Independent Expert for FP7 (Independent Expert, FP7, Cordis, Expert Management Module, Number:EX2002B014021). He handle "Excellent Participant Award", '95 TCDC SHP Training Workshop (Funded by UNDP), 1995. He placed in "Listing in IBC Outstanding Scientists of the 21st Century, Inaugural Edition, 2007" and "Listing in Marquis Who's Who in Science and Engineering, 9th Edition, 2006-2007". Dr. Comlekci has founded the first Turkish Chapter of IEEE, Engineering in Medicine and Biology Society in 2005. He is currently Chair of the Chapter. He has published nearly 100 technical papers in journals and conference proceedings. He is conducting national and international Research Projects in Biomedical Engineering. He worked at Arizona State University, USA, Ira A. Fulton School of Engineering, Harrington Department of Bioengineering as an Adjunct Faculty and Visitor Scientist in Dr. Akay's Lab during 2007 for post-doc study.