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

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Keynote Lecture 1

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

Dr. D. P. Kothari
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Former Director General, RGI, Nagpur
Former Director General, VITS Indore
Former Vice Chancellor, VIT Vellore
Former Director I/c IIT Delhi
India
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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.

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Keynote Lecture 2

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

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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 explcit 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 Arbour 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 politicial 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

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

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Plenary Lecture 1

Tropical Optimization: Some Problems, Methods, and Applications

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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 stared 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.

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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
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Chalkis Institute of Technology
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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
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Policy & Energy Management, Renewable Energy Niche and
Head Centre for Engineering Education Research
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
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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 Nicheand 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.

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Plenary Lecture 4

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

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Abstract: Especially last decade brought important developments in the theory of HighDimensional Model Representation (HDMR) which was first proposed by Sobolin 1993. In its first format, HDMR was a function decomposition in ascend ing multivariance. A given target multivariate function was expressed the sumof a single constant term that is followed by N number of univariate functioncomponent each of which depends on a di erent but single independent variableand bivariate terms group composed of bivariate functions each of which de pends on a di erent couple of independent variables and so on. Sobol proposedvanishing conditions for HDMR components such that each component exceptthe constant one should vanish if it is integrated between 0 and 1 inclusive withrespect to anyone of its arguments. These conditions were su cient to un quelydetermine each HDMR component as long as the target function is integrablein the hypercube whose one corner is located at the origin while its each edgeresides in a di erent axis' positive half.
Herschel Rabitz brought the nonunit weight concept under the product typeassumption (it is product of the univariate functions each of which is a weightfunction depending on a di erent independent variable) and extended the ge ometry from unit hypercube to hyperprisms. Demiralp group revealed manyimportant properties of HDMR and developed various e ective HDMR versionsto increase the truncated HDMR approximants. As state of art developments,factorized, hybrid, transformational HDMR varieties have been arisen while theproduct type hypothesis has also been relaxed. As a quite recently developedand more enthusiastic approach, "Enhanced Multivariate Product Represen tation" has shown up in the stage to more delicately control the truncationapproximant quality. The further studies are also in the air at the present time.This talk focuses on the univariate exponential functions whose argumentis a multivariate function. The argument function has been taken as at mostquadratic form structure even though it may be complicated for more rigorousapplication. What we report here is the application of HDMR in in finite dimen sional space to this type of functions and to show a rather detailed investigationresults together with interpretations.

Brief Biography of the Speaker: N. A. BAYKARA was born in Istanbul,Turkey on 29th July 1948. He received aB.Sc. degree in Chemistry from Bosphorous University in 1972. He obtained his PhDfrom Salford University, Greater Manchester, Lancashire,U.K. in 1977 with a thesis entitled “Studies in Self Consistent Field Molecular Orbital Theory”, Between the years1977–1981 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 hedid 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 aFull Professor of Applied Mathematics mainly teaching Numerical Analysis courses and isinvolved in HDMR research and is a member of Group for Science and Methods of Computing in Informatics Institute of Istanbul Technical University. Other research interestsof his for him are “Density Functional Theory” and “Fluctuationlessness Theorem and itsApplications” which he is actually involved in. Most recent of his concerns is focused atefficient remainder calculations of Taylor expansion via Fluctuation–Free ˙Integration, andFluctuation–Free Expectation Value Dynamics.

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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
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Faculty of Technological Engineering and Industrial Management
Transilvania University of Brasov
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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 Transylvania 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.

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Plenary Lecture 6

Parametric Design for Adhesive Dispensing Process in Electronics Manufacturing

Professor Jay (Chien-Yi) Huang
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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 additional 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.

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Plenary Lecture 7

Electronic Circuit Design For Ensuring Safety Of Business in Band Systems

Associate Professor Selcuk Comlekci
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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 pres 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 Instıtute 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 Comittee on Electromagnetic Safety) chose him as a member of ICES TC95 Main Committee in 2008. He is the third member from Turkey in this comittee. 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.

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