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# **RECENT ADVANCES in SYSTEM SCIENCE and SIMULATION in ENGINEERING**

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

**Proceedings of the 7th WSEAS International Conference  
on SYSTEM SCIENCE and SIMULATION in ENGINEERING (ICOSSE '08)**

**VENICE, ITALY, NOVEMBER 21-23, 2008**

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## **Preface**

This book contains the proceedings of the 7th WSEAS International Conference on SYSTEM SCIENCE and SIMULATION in ENGINEERING (ICOSSE '08) which was held in Venice, Italy, November 21-23, 2008. This conference aims to disseminate the latest research and applications in Systems Theory, Fuzzy Systems, Neural Networks, Electronics and Power Electronics, Parallel and Distributed Systems, Simulation Environments and other relevant topics and applications.

The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers. The WSEAS Conferences attract a large number of well-established and leading researchers in various areas of Science and Engineering as you can see from <http://www.wseas.org/reports>. Your feedback encourages the society to go ahead as you can see in <http://www.worldses.org/feedback.htm>

The contents of this Book are also published in the CD-ROM Proceedings of the Conference. Both will be sent to the WSEAS collaborating indices after the conference: [www.worldses.org/indexes](http://www.worldses.org/indexes)

In addition, papers of this book are permanently available to all the scientific community via the WSEAS E-Library.

Expanded and enhanced versions of papers published in this conference proceedings are also going to be considered for possible publication in one of the WSEAS journals that participate in the major International Scientific Indices (Elsevier, Scopus, EI, ACM, Compendex, INSPEC, CSA .... see: [www.worldses.org/indexes](http://www.worldses.org/indexes)) these papers must be of high-quality (break-through work) and a new round of a very strict review will follow. (No additional fee will be required for the publication of the extended version in a journal). WSEAS has also collaboration with several other international publishers and all these excellent papers of this volume could be further improved, could be extended and could be enhanced for possible additional evaluation in one of the editions of these international publishers.

Finally, we cordially thank all the people of WSEAS for their efforts to maintain the high scientific level of conferences, proceedings and journals.



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## Keynote Lecture

### Multivariate Data Completion or Addition on a Single Curve Representation of a Hyperrectangulargrid via Fluctuation Suppression



**Professor Metin Demiralp**

Istanbul Technical University, Informatics Institute,  
Group for Science and Methods of Computing,  
Istanbul, TURKIYE

**Abstract:** This work is somehow about multivariate interpolation. If an  $N$ -variate function is given at certain points of the cartesian space of the  $N$  independent variables and its value at a point which is outside the data given points is sought then various methods available in the literature can be used to find this value. However, there is almost no unique universal way to do so and each method has its own capability, efficiencies, deficiencies and pitfalls. Data completion and data mining techniques can also be considered amongst them.

The work focuses on a finite hypergrid in  $N$ -dimensional cartesian space first and then a multivariate function's values are assumed to be given at certain nodes (we call them full nodes) of this grid. The next step is the dimension reduction. To this end we construct a single continuous curve passing through all nodes of the grid with respect to an appropriately chosen ordering. Curve construction is not unique and depends on the ordering of the nodes. It is better to choose the curves whose mathematical definitions are rather simple. This construction leaves us to use just a single parameter to specify any location on the curve. Although the nodes are defined as  $N$  tuples in the  $N$ -dimensional cartesian space their locations can also be given in terms of the curve parameter. Hence, the data completion or addition problem is converted to a univariate interpolation which is rather simple.

The full nodes are now represented by ordered pairs whose first elements are the position parameter values on the constructed curve while the second elements are the multivariate function's values at those points. Data completion (to inject one or a few missing data to a data set which is almost full everywhere) or data addition (to evaluate the function's value at an empty node within a sparsely data given hypergrid) then becomes to seek the multivariate function's value at a specified node which corresponds to a unique position on the curve.

There are a lot of univariate interpolation methods, each of which can be used for the interpolation on the curve defined above depending on the nature of the demands and produces some unavoidable errors. Quite recently a new method of interpolation is developed by Demiralp. It uses the Fluctuationlessness Theorem (conjectured and proven by Demiralp recently). Theorem dictates us that the matrix representation of a function over a subspace of the Hilbert space for analytic and square integrable functions is equal to the image of the independent variable's matrix representation on the same subspace under the same function as long as the fluctuation terms (differences between the means of specified powers of the independent variable and the same specified power of the mean of the independent variable). This fact can be used to approximate an integral and a quadrature like formula (the linear combination of the function values at certain points with positive linear combination coefficients (we call weights) can be obtained. The quality of the approximation depends on the dimension of the subspace mentioned above and becomes better as the dimension increases. Hence the two sufficiently high consecutive dimension will give the same value for the integration under consideration within a prescribed accuracy.

The integrand of the abovementioned integral is chosen in such a way that it becomes a linear combination of given values of the multivariate function for, say,  $n$  dimensional subspace while the same value is expressed as another linear combination of the given function values and the single sought values of the same function for the  $(n + 1)$  dimensional subspace. Since these two expressions should produce the same value it is possible to extract the sought value of the function under consideration. Presentation will focus on these topics and certain remarks.

**Acknowledgment:**

Author is grateful to Turkish Academy of Sciences for its support.

**Brief Biography of the Speaker:** Metin Demiralp was born in Turkey on 4 May 1948. His education from elementary school to university was all in Turkey. He got his BS, MS, 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 is working on methodology for computational sciences. 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. H. A. Rabitz's group at Princeton University (NJ, USA) at summer and winter semester breaks during the period 1985--2003 after his 14 months long postdoctoral visit to same group in 1979--1980.

Metin Demiralp has roughly 70 papers in well known scientific journals and is the full member of Turkish Academy of Sciences ince 1994. He is also a member of European Mathematical Society and the chief--editor of WSEAS Transactions on Mathematics currently. He has also two important awards of Turkish scientific establishments.

## Plenary Lecture I

### The Software agent Paradigm as a Powerful Simulation Tools to Support Modelling of Complex Systems. The Cases of Consumer Markets and Telecom Architectures.



**Professor Filippo Neri**  
Marie Curie Fellow  
University of Piemonte Orientale  
ITALY  
E-mail: [neri@mfn.unipmn.it](mailto:neri@mfn.unipmn.it)

**Abstract:** In the talk we will describe how the software agent paradigm can be a powerful and versatile simulation tool to model and study complex systems, allowing to fast prototype approximate solutions to difficult problems and to easily select which ones to take forward at the deployment stage.

To support our position, we will introduce two different domains: consumer decisions in fast moving consumers goods and mobile telecom network management applications. Then we will shows two interesting research problems faced today the expert in those fields. And we will show how a software agent modeling approach could be used to increase the understanding of the problems, their modelization, and the proposal of alternative solutions. In particular, in the talk, we will show how an agent based tool for analysing markets behaviour under several rate of information diffusion can be developed. This methodology has allowed for the study of tradeoffs among several variables of information like product advertisement efforts, consumers' memory span, and passing word among friends in determining market shares.

Concerning the mobile telecom domain, we will propose how to study the impact of moving from a centralized network management architecture toward a distributed one, where each network management application consists of a controller part and a set of distributed parts running on the individual network elements.

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

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

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

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



## Plenary Lecture II

### Fatigue Data Analysis and Life Assessment Using Signal Processing Approaches



**Associate Professor Shahrum Abdullah**

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**Abstract:** This work discusses the fatigue life assessment using signal processing approaches which study on the characteristics of the fatigue signal in frequency and time-frequency domain. The signals used in this research were variable amplitude fatigue signal which consisted of a synthetic data and experimentally measured data. As frequency domain method is one of the techniques to analyse random signal, it can be applied to observe strain characteristic of the signal in frequency domain. Thus, Power Spectral Density (PSD) algorithm was used to gain the power distribution of the input signals. The short-time Fourier transform (STFT), wavelet transform and S-transform methods were also used to transform the input signal into the time-frequency domain. The transformation of time domain signal into time-frequency domain provides the power distribution display with respect to the particular time and frequency information. From the power distribution gained, the fatigue damage features can be identified. Finally, the life estimation of the components can be calculated from all the extracted fatigue features in order to study the durability of an automotive component.

**Brief Biography of the Speaker:** Dr. Shahrum Abdullah is the lecturer in Department of Mechanical and Materials Engineering, Universiti Kebangsaan Malaysia. He obtained his first degree in Mechanical Engineering at Universiti Kebangsaan Malaysia in 1995. In 1997, he obtained his MSc (Engineering Design) degree from Loughborough University of United Kingdom. In 2005, Finally, he was awarded the Ph.D. degree in Mechanical Engineering at the University of Sheffield, United Kingdom. His PhD thesis is within the scope of fatigue data analysis using the signal processing method, particularly the wavelet transform, which are the core research activities in his current days. Dr. Shahrum Abdullah authored many papers related to his specialization (engineering design and fatigue life assessment) in many international journals and proceedings.

## Plenary Lecture III

### Using Robust Outlier Detection to Identify Possible Flood Events



**Assoc. Professor Azami Zaharim**

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**Abstract:** The least squares method has been widely used in time series forecasting and outlier detection. However, the method is not very efficient in identifying outliers because it suffers the masking effect. The aim of this study is to overcome the masking effect by implementing the robust least median squares method in outlier detection. To illustrate, we identified the possible outliers from sixty-one readings of the daily rainfall recorded at Kajang JPS telemetric station. The outliers are then categorized into innovational outlier and additive outlier. Results based on both techniques were compared and it is found that the least median squares method effectively unmasked the effect of outliers as compared to the least squares method.

**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 Coordinator for the Unit Fundamental Engineering Studies. 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 80 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. 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.

## Special Session I

### Applied Simulation to Improve Logistics in Industry



**Organizer:**

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