



Editor

Valeri Mladenov



Associate Editors

Francesco Mainardi

Clemente Cesarano

Non-linear Systems, Nanotechnology

- **Proceedings of the 14th International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '15)**
- **Proceedings of the 6th International Conference on Nanotechnology (NANOTECHNOLOGY '15)**

Rome, Italy, November 7-9, 2015



NON-LINEAR SYSTEMS, NANOTECHNOLOGY

Proceedings of the 14th International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '15)

Proceedings of the 6th International Conference on Nanotechnology (NANOTECHNOLOGY '15)

**Rome, Italy
November 7-9, 2015**

Recent Advances in Electrical Engineering Series | 55

ISSN: 1790-5117
ISBN: 978-1-61804-345-0

NON-LINEAR SYSTEMS, NANOTECHNOLOGY

Proceedings of the 14th International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '15)

Proceedings of the 6th International Conference on Nanotechnology (NANOTECHNOLOGY '15)

**Rome, Italy
November 7-9, 2015**

Published by WSEAS Press
www.wseas.org

Copyright © 2015, 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.

ISSN: 1790-5117
ISBN: 978-1-61804-345-0

NON-LINEAR SYSTEMS, NANOTECHNOLOGY

Proceedings of the 14th International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '15)

**Proceedings of the 6th International Conference on Nanotechnology
(NANOTECHNOLOGY '15)**

**Rome, Italy
November 7-9, 2015**

Editor:

Prof. Valeri Mladenov, Technical University of Sofia, Bulgaria

Associate Editors:

Prof. Francesco Mainardi, University of Bologna & INFN, Italy

Prof. Clemente Cesarano, International Telematic University UNINETTUNO, Italy

Committee Members-Reviewers:

Jose Alberto Duarte Moller

Valeriu Prepelita

Zengshi Chen

Valeriy Perminov

Elena Scutelnicu

Mihaiela Iliescu

Konstantin Volkov

Nikos Loukeris

Sorinel Oprisan

Harry Coomar Shumsher Rughooputh

Mihaela Dudita

Agoujil Said

Najib Altawell

Muhammad Musaddique Ali Rafique

Mariya Aleksandrova

Mahboobeh Mahmoodi

Constantin Popescu

Mueen Uddin Awan

Arvind Dhingra

Yang Zhang

Daniela Cristina Momete

Rajveer Mittal

Mahdi Faraji

Katerina Hyniova

Mahesh Chavan

Harjit Pal Singh

Md. Jakir Hossen

Ming-Shen Jian

Mihai Timis

Mohamed Zahran

Yu Zhang

Muhammet Koksal

Dana Anderson

Diego Pinto Roa

Petr Hajek

Amjad Mahmood

Al Emran Ismail

Guoxiang Liu

Snezhana Georgieva Gocheva-Ilieva

Kevin Kam Fung Yuen

M. M. Noor

Hamed Ziaeeipoor

Md. Shamim Akhter

Hongjun Liu

Jiri Hrebicek

Eleazar Jimenez Serrano

Claudia-Georgeta Carstea

Takuya Yamano

Hime Aguiar

Satish Kumar Duraiswamy

David Nicoleta

Huashui Zhan

Preface

This year the 14th International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '15) and the 6th International Conference on Nanotechnology (NANOTECHNOLOGY '15) were held in Rome, Italy, November 7-9, 2015. The conferences provided a platform to discuss nanomaterials, nanoparticles and colloids, nanomedicine, molecular self-assembly, nanoelectronics, molecular nanotechnology, non-linear systems in science, non-linear systems in engineering, chaos and chaotic behavior etc. with participants from all over the world, both from academia and from industry.

Their 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 these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as 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

Plenary Lecture 1: Ultrasonic Nano Manipulations	12
<i>Junhui Hu</i>	
Plenary Lecture 2: Fractional Calculus: What Is It? And What Is It for?	13
<i>Francesco Mainardi</i>	
Plenary Lecture 3: Further Developments in the Emulation of Non-Linear Acoustic Systems	14
<i>Lamberto Tronchin</i>	
Generalized Hermite Polynomials in the Description of Multi-Index Bessel Functions	15
<i>Clemente Cesarano, Claudio Fornaro</i>	
Reacting Fronts in Random Environments	20
<i>Gianni Pagnini, Rinie Akkermans, Andrea Mentrelli, Nadine Buchmann</i>	
Non-Linear Problems in Electromagnetics: Periodical Transmission Lines	26
<i>Dario Assante, Clemente Cesarano</i>	
Nanocomposite Coating Created by Electrocodeposition Method	31
<i>Alexander Vakhrushev, Eugene Molchanov</i>	
Capture of Cationic Metal Ions from Aqueous Solutions by Layered Double Hydroxides Intercalated with Organic Acid Anions	41
<i>Tomohito Kameda, Tetsu Shinmyou, Toshiaki Yoshioka</i>	
A Note on Modified Humbert Functions	47
<i>Clemente Cesarano</i>	
Multiple Equilibria in Labour Market: The Case of the Czech Republic	52
<i>Ondřej Čížek</i>	
Stability Analysis of Nonlinear Nonstationary Systems with Respect to a Part of Variables via Averaging	57
<i>Alexander Aleksandrov, Elena Aleksandrova, Yangzhou Chen</i>	
First Considerations on Regular and Singular Perturbations for Fractional Differential Equations	62
<i>Moreno Concezzi, Renato Spigler</i>	
Design of an Augmented Automatic Choosing Control via GA for a Class of Nonlinear Systems with Constrained Input	68
<i>Toshinori Nawata</i>	
A Stochastic Process for the Puzzling Framework of Anomalous Diffusion in Biological Systems	75
<i>Daniel Molina-García, Tuan Pham Minh, Gianni Pagnini</i>	
Parametrical Oscillations of Nanostrings with Alternating Currents	81
<i>Morozov N. F., Indeitsev D. A., Privalova O. V., Skubov D. Yu., Shtukin L. V.</i>	

Quantum Theory of the Optical, Atomic and Nuclear Goos-Hänchen Shift	90
<i>Jacek Jakiel, Wieslaw Kantor</i>	
On Finite Difference Approximations of Havriliak-Negami Operators	97
<i>Roberto Garrappa</i>	
Extremal Curves of a Total Curvature Type Energy	103
<i>J. Arroyo, O. J. Garay, A. Pámpano</i>	
Research and Forecasting of Properties of Metallic Nanocomposites and Nanoaerosol Systems	113
<i>Alexander Vakhrushev, Aleksey Fedotov, Golubchikov Valery</i>	
Bank Contagion: the Spread of Defaults	121
<i>Chiara Benazzoli, Luca Di Persio</i>	
Fabrication of Slanted Nanostructures Using a Faraday Cage System	126
<i>Jun-Hyun Kim, Sung-Woon Cho, Chang-Koo Kim</i>	
Additive Topological Theory for Birkhoff's Curves	130
<i>Dmitry W. Serow</i>	
High Performance CUDA Based CNN 2D Sound Propagation Simulator	138
<i>George Valentin Stoica, Radu Dogaru, Elena Cristina Stoica</i>	
Phase Dependent Magnetic Properties of Neodymium Doped Yttriumdisilicates	142
<i>Murat Erdem, Cihat Boyraz</i>	
Vision-Based Path Control for Differential-Drive Mobile Robots	149
<i>Plamen Petrov, Lubomir Dimitrov</i>	
A Comparison of Bandwidth Selection Methods for Kernel Smoothing	155
<i>Dursun Aydin, Mustafa Şeref Tüzemen</i>	
Time Delay Neural Network for Recognition of Whistler Waves	159
<i>Livio Conti, Paolo Maria Innocenzi, Luca Placidi</i>	
Some Transcendental Equations on the Stieltjes Cone and Energy Thresholds for Quantum Correlations	169
<i>Filippo Giraldi</i>	
The LQG with Kalman Filter and the Loop Shaping Robust Approach for Power System Stabilizers Design	179
<i>Kabi Wahiba, Nacéri Abdellatif, Ghouraf Djamel Eddine</i>	
Numerical Simulation for Forward Backward Stochastic Differential Equation	185
<i>Youssef El-Khatib</i>	
On Asymptotics of Double Oscillatory Integrals: Contribution of Critical Points of the Second Kind	191
<i>Abdallah Benaissa</i>	

Performance of Analog Network Coding Based Satellite Systems in the Presence of High Power Amplifier Nonlinearities	197
<i>Khaled Ali Abuhasel, Ateeq Ahmed Khan, Ahmed Mustafa Hussein, Ishtiaq Ahmad</i>	
1-Soliton Solutions of the Drinfel'd-Sokolov Equation with General Evolution	202
<i>Samia Ouamane</i>	
Theoretical Estimation and Frequency Performance Analysis of AlGaN/GaN Single Quantum Well Short Wavelength Transistor Laser	209
<i>Behzad Hakkari, Hassan Kaatuzian, Iman Taghavi, Hassan Rahbardar Mojaver</i>	
Authors Index	217

Plenary Lecture 1

Ultrasonic Nano Manipulations



Professor Junhui Hu

State Key Lab of Mechanics and Control of Mechanical Structures
Nanjing University of Aeronautics and Astronautics
China

E-mail: ejhhu@nuaa.edu.cn

Abstract: Ultrasonic nano manipulation is an emerging technology, which has great potential applications in the assembly, measurement and fabrication of nano materials, handling of biological samples, manufacturing of nano sensors, new material syntheses, etc. In recent three years, the author's research team proposed and developed a series of ultrasonic manipulating devices with the functions such as nano trapping and transfer, nano rotary driving, and nano concentration. Controlled acoustic streaming eddies are used in the nano manipulations. Compared with the nano manipulation techniques based on other physical principles, our devices have the features such as very low temperature rise at the manipulation area, little selectivity to manipulated samples, capability of implementing the manipulation on substrates given by customers. etc. In this report, we introduce the principles, structures, functions, and characteristics of the ultrasonic nano manipulating devices proposed and developed by our group, and predict the development trend of this area.

Brief Biography of the Speaker: Junhui Hu is a Chang-Jiang Distinguished Professor, China, the director of Precision Driving Lab at Nanjing University of Aeronautics and Astronautics, and the deputy director of State Key Laboratory of Mechanics and Control of Mechanical Structures, China. He received his Ph.D. Degree from Tokyo Institute of Technology, Tokyo, Japan, in 1997, and B. E. and M. E. degrees in electrical engineering from Zhejiang University, Hangzhou, China, in 1986 and 1989, respectively. He was an assistant and associate professor at Nanyang Technological University, Singapore, from 2001 to 2010. His research interest is in piezoelectric/ultrasonic actuating technology. He is the author and co-author of more than 200 papers and disclosed patents, including more than 80 full papers published in SCI journals and 1 editorial review in an international journal. He is also the sole author of monograph book "Ultrasonic Micro/Nano Manipulations" (2014, World Scientific, Singapore). Dr. Hu won the Paper Prize from the Institute of Electronics, Information and Communication Engineers (Japan) as the first author in 1998, and his research work has been highlighted by 7 international scientific media. He is a senior member of IEEE, and the editorial board member of two international journals. He was once awarded the title of valued reviewer by Sensors and Actuators A: Physical and Ultrasonics. He has given ten invited talks at international conferences, and is the honorary chairman of IWPMA 2011, held in USA.

Plenary Lecture 2

Fractional Calculus: What Is It? And What Is It for?



Professor Francesco Mainardi

Department of Physics

University of Bologna

&

INFN

Italy

E-mail: francesco.mainardi@bo.infn.it

Abstract: In 1695 L'Hospital inquired to Leibniz what meaning could be given to the symbol $d^n y/dx^n$ when $n = 1/2$. In a letter dated September 30, 1695 Leibniz replied "It will lead to a paradox, from which one day useful consequences will be drawn". This discussion led to a new branch of mathematics which deals with derivatives and integrals of arbitrary order and is known as Fractional Calculus. Of course this is a misnomer kept only for historical reasons. It can be considered as a branch of mathematical analysis which deals with integro-differential operators and equations where the integrals are of convolution type and exhibit (weakly singular) kernels of power-law type. It is strictly related to the theory of pseudo-differential operators. Fractional differential and integral equations have gained considerable popularity and importance during the past three decades. The main advantage of the fractional calculus is that provides excellent instruments for the description of memory and non local properties of various materials and processes. The list of applications is huge and includes, just to cite a few, Visco-elasticity, Electrical Circuits, Control theory, intermediate phenomena between Diffusion and Wave propagation, Biology, Bioengineering, Image processing, Finance, Stochastic processes.

Brief Biography of the Speaker: Presently Francesco MAINARDI is retired professor of Mathematical Physics from the University of Bologna where has taught this course since 40 years. His fields of research concern several topics of applied mathematics, including diffusion and wave problems, asymptotic methods, integral transforms, special functions, fractional calculus and non-Gaussian stochastic processes. At present his H-index is > 40 . For a full biography, list of references on author's papers and books see: Home Page: <http://www.fracalmo.org/mainardi/index.htm> and <http://scholar.google.com/citations?user=UYxWyEEAAA&hl=en&oi=ao>

Plenary Lecture 3

Further Developments in the Emulation of Non-Linear Acoustic Systems



Professor Lamberto Tronchin

DN - CIARM

University of Bologna

Italy

E-mail: Lamberto.tronchin@unibo.it

Abstract: It is well-known in acoustics that the emulation of the acoustics of a theatre or an auditorium could be obtained by means of convolution between dry signal and a properly-measured impulse response. However, a considerable number of audio devices (as valve amplifier or musical instruments) could definitely not be considered as linear and time-invariant systems. By using Hammerstein or Wiener series it is possible to represent the input-output relationship of nonlinear systems. These two methods could be generalised using Volterra model. It uses a set of impulse responses to describe the system and not only one as before. By an enhanced impulse response measurement method it is possible to obtain this set of impulses and then with Volterra series it would be possible to have the output of the audio system driven by any input. A special numerical tool has been developed to recreate the system behaviour by using this method. This method has been recently further developed, taking into consideration the effects of amplitude during the emulation of the device and the proper determination of the most suitable set of distortion considering the RMS value of the “dry signal” to be used for the emulation. In the lecture, the most remarkable results will be presented.

Brief Biography of the Speaker: Dr Lamberto Tronchin is Associate Professor in Environmental Physics from the University of Bologna and is recognised internationally as a leading authority on the subject of sound and acoustics. A pianist himself, with a diploma in piano from the Conservatory of Reggio Emilia, Dr Tronchin's principal area of research has been musical acoustics, room acoustics and signal processing. He is Associate Editor of the Journal of AES, and the author of more than 200 papers and was Chair of the Musical Acoustics Group of the Italian Association of Acoustics from 2000 to 2008. Dr Tronchin is a member of the Scientific Committee of the CIARM, the Inter- University Centre of Acoustics and Musical research, has chaired sessions of architectural and musical acoustics during several international symposiums, been a referee for a number of International journals and is Chair of Organising and Scientific Committees of IACMA (International Advanced Course on Musical Acoustics). He was a visiting researcher at the University of Kobe in Japan, a visiting professor at the University of Graz in Austria and Special honored International Guest at the International Workshop, 'Analysis, Synthesis and Perception of Music Signals', at Jadavpur University of Kolkata, India in 2005. He has chaired the International Advanced Course on Musical Acoustics (IACMA), organised with the European Association of Acoustics, which was held in Bologna, in 2005. Since 2008 he gave plenary lectures at International Congresses on Acoustics in Vancouver, Prague, Bucharest, Santander, Kos, Malta, Paris, Cambridge (UK), Salerno, Geneve. He designed theatres and other buildings, as acoustic consultant, in collaboration with several Architects, among them Richard Meier and Paolo Portoghesi.

Authors Index

Abdellatif, N.	179	Innocenzi, P. M.	159
Abuhasel, K. A.	197	Jakiel, J.	90
Ahmad, I.	197	Kaatuzian, H.	209
Akkermans, R.	20	Kameda, T.	41
Aleksandrov, A.	57	Kantor, W.	90
Aleksandrova, E.	57	Khan, A. A.	197
Arroyo, J.	103	Kim, C.-K.	126
Assante, D.	26	Kim, J.-H.	126
Aydin, D.	155	Mentrelli, A.	20
Benaissa, A.	191	Minh, T. P.	75
Benazzoli, C.	121	Mojaver, H. R.	209
Boyraz, C.	142	Molchanov, E.	31
Buchmann, N.	20	Molina-García, D.	75
Cesarano, C.	15, 26, 47	Morozov, N. F.	81
Chen, Y.	57	Nawata, T.	68
Cho, S.-W.	126	Ouamane, S.	202
Čížek, O.	52	Pagnini, G.	20, 75
Concezzi, M.	62	Pámpano, A.	103
Conti, L.	159	Petrov, P.	149
Di Persio, L.	121	Placidi, L.	159
Dimitrov, L.	149	Privalova, O. V.	81
Dogaru, R.	138	Serow, D. W.	130
Eddine, G. D.	179	Shinmyou, T.	41
El-Khatib, Y.	185	Shtukin, L. V.	81
Erdem, M.	142	Skubov, D. Yu.	81
Fedotov, A.	113	Spigler, R.	62
Fornaro, C.	15	Stoica, E. C.	138
Garay, O. J.	103	Stoica, G. V.	138
Garrappa, R.	97	Taghavi, I.	209
Giraldi, F.	169	Tüzemen, M. Ş.	155
Golubchikov, V.	113	Vakhrushev, A.	31, 113
Hakkari, B.	209	Wahiba, K.	179
Hussein, A. M.	197	Yoshioka, T.	41
Indeitsev, D. A.	81		