Non-Linear Systems & Wavelet Analysis

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- 10th WSEAS International Conference on Wavelet Analysis & Multirate Systems (WAMUS '10)
- 9th WSEAS International Conference on Non-Linear Analysis, Non-Linear Systems and Chaos (NOLASC '10)

Kantaoui, Sousse, Tunisia, May 3-6, 2010

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Preface

This year the 10th WSEAS International Conference on WAVELET ANALYSIS & MULTIRATE SYSTEMS (WAMUS '10) and the 9th WSEAS International Conference on NON-LINEAR ANALYSIS, NON-LINEAR SYSTEMS and CHAOS (NOLASC '10) were held in Kantaoui, Sousse, Tunisia, May 3-6, 2010. The conferences remain faithful to their original idea of providing a platform to discuss construction of wavelets, discrete and continuous transforms, filter banks and transmultiplexers, biorthogonal wavelets, lossless systems, mathematical wavelet analysis, multiwavelets, wavelet transforms, wavelet-based optimization, non-linear systems in science and engineering, chaos and chaotic behavior, chaos in science and engineering 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 indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in 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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Plenary Lecture 1

Chaotic Dynamics of a Triple Pendulum: Numercial vs. Experimental Investigations

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Abstract: The triple physical pendulum is designed as a system of two symmetrically joint pendulums to eliminate stress caused by torques and/or forces out of the pendulum's plane dynamics ((see [1], [2], [3]). It possesses a module-like structure and a stand being symmetrical steel welded construction. The pendulum-driving subsystem consists of two engines of slow alternating currents and optoelectronic commutation. The engine stator has been designed in such a way that the current intensity in the windings is linearly dependent on the engine torque owing to the removal of the ferromagnetic cores. The LabView software environment is applied. Namely, blocks are linked by lines of various colors and patterns in the environment and represent some predefined application procedures (reading and writing to channel inputs and outputs, numerical analysis, etc.) A series of measured data is stored in the text files and shown in various wave form graphs. In addition, a mathematical model of the experimental rig is derived as a system of three second order strongly nonlinear ODEs. Mathematical modeling includes details, taking into account some characteristic features (for example, real characteristics of joints built by the use of roller bearings) as well as some imperfections (asymmetry of the forcing) of the real system. Parameters of the model are obtained by a combination of the estimation from experimental data and direct measurements of the system's geometric and physical parameters. A few versions of the model of resistance in the joints are tested in the identification process. Good agreement between both numerical simulation results and experimental measurements have been obtained and presented. Some novel features of our real system chaotic dynamics have been reported.

Plenary Lecture 2

Linear and Weakly Nonlinear Instability of Fluid Flows

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Abstract: Linear stability theory is widely used in fluid mechanics to predict when a particular base flow becomes unstable. The critical values of the parameters of the problem (for example, the critical Reynolds numbers) are usually calculated by solving the corresponding linearized eigenvalue problem. The structure of the critical motion which takes place just above the threshold can also be analyzed by means of the linear stability theory. However, the evolution of the most unstable disturbance above the threshold cannot be described by the linear theory.
Weakly nonlinear theories are used in such cases to derive an amplitude evolution equation (or a system of evolution equations). The coefficients of such equations (one example is the complex Ginzburg-Landau equation) can be calculated by means of the method of multiple scales.
In this plenary talk we discuss both linear and weakly nonlinear models of fluid motion in detail. Two examples are considered: stability of shallow water flows and stability of transient rapidly decelerated flow in a circular pipe. The results of joint work with Prof. M.S. Ghidaoui are discussed.

Brief Biography of the Speaker:
Andrei Kolyshkin received his undergraduate degree in Applied Mathematics in 1976 at the Riga Technical University. In 1981 he received a Ph.D in differential equations and mathematical physics at the University of St. Petersburg. Andrei Kolyshkin is currently a full professor at the Department of Engineering Mathematics at the Riga Technical University. His current research interests include investigation of stability problems in fluid mechanics with applications to open-channel flows and transient flows in hydraulic systems and mathematical models for eddy current testing. He is the co-author of three monographs published by Academic Press and CRM. Andrei Kolyshkin has participated in more than 30 international conferences and has published more than 50 papers in refereed journals since 1990. As a visiting professor and visiting researcher he spent a few years at the University of Ottawa and Hong Kong University of Science and Technology.

Plenary Lecture 3

Machining Process & System Dynamics Identification by Using Chaotic Models

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Abstract: To reach the best momentary values of the machining process performances (concerning productivity, precision, surface quality etc.) it is necessary to continuously monitor the deviations from the programmed values of the cutting process parameters (caused especially by instability) and to counteract them. This is possible only if we have a technological system's dynamics model to express the relation between the machining process input parameters and their consequences regarding the stability. Such a model may be developed by starting from the equations characterizing the physical process or by identification. During the last decades, several models were suggested and, more or less, validated in practice. They all have two major inconvenient: i) the machining process and the machining system are treated separately and ii) they cannot give information about the position of the system's current functioning point relative to its stability limit. By assuming the potential chaotic character of the cutting process dynamics, we made investigations concerning the possibility of identifying the dynamics of both machining process & system, considered together as a unique entity. There are more, well known, chaotic classic models: logistic, Henon, Lorenz etc. After thoroughly analyzing them, we chose the logistic (one-dimensional) model as the most appropriate to be used for characterizing the cutting force (or the acceleration) variation during a cutting process and thus, to identify the machining process & system dynamics. By online monitoring the momentary value of the logistic model control parameter and by comparing it to a critical value, the position of the system's current functioning point relative to its stability limit may be known.

Brief Biography of the Speaker:
Gabriel Frumusanu graduated a 5 years Mechanical Engineering degree program at "Dunarea de Jos" University of Galati (1987); PhD in Industrial Engineering - at "Dunarea de Jos" University of Galati (1999); Training stages at: "Ecole des Mines de Paris", CEMEF, Sophia-Antipolis – France (1992); "Universita degli Studi di Padova", Padua – Italy (1997); "Ecole Nationale Superieure des Artes et Metiers", Angers – France (2002). Research fields: numerical modeling of manufacturing processes and surfaces generation; cutting processes dynamics; metals cold forming (deep drawing, extrusion, orbital volumetric cold forming). Professional experience: 1988 – 1990 – Engineer responsible of equipments maintenance at Cold Rolling Mill from Galati Iron and Steel Company; 1990 – 2000 – Assistant-professor at "Dunarea de Jos" University of Galati, Manufacturing Science and Engineering Department; 2000 – 2004 – Associate-professor, in the same department; 2004 up to present – Professor, in the same department.

Prof. Frumusanu participated in over 20 research projects supported by Romanian Ministry of Education and Science; author / co-author of over 20 scientific or didactic books; over 100 scientific papers written or co-authored, published to International / National Conferences proceedings (Spain, France, Hungary, Israel, Moldavia) and Journals. Invited professor at "Universita degli Studi di Padova", Padua – Italy (2006). Member of professional and scientific associations: Romanian Association for Non-Conventional Technologies - ARTN, Romanian Association of Managers and Engineers - AMIER, Romanian Association of Tensometry - ARTENS; Expert of Romanian National University Research Council - CNCSIS and of Romanian Agency for Quality Assurance in Higher Education - ARACIS.

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