Journal of Applied Nonlinear Dynamics

Editors

J. A. Tenreiro Machado

ISEP-Institute of Engineering of Porto Dept. of Electrical Engineering

Rua Dr. Antonio Bernardino de Almeida 431, 4200-072 Porto

Portugal

Fax:+ 351 22 8321159 Email: jtm@isep.ipp.pt

Associate Editors

J. Awrejcewicz

Department of Automatics and Biomechanics K-16, The Technical University of Lodz, 1/15 Stefanowski St., 90-924 Lodz, Poland

Fax: +48 42 631 2225, Email:

awrejcew@p.lodz.pl

Dumitru Baleanu

Department of Mathematics and Computer Sciences Cankaya University Balgat, 06530, Ankara, Turkey Fax: +90 312 2868962

Email: dumitru@cankaya.edu.tr

Nikolav V. Kuznetsov

Mathematics and Mechanics Faculty Saint-Petersburg State University Saint-Petersburg, 198504, Russia

Fax:+ 7 812 4286998

Email: kuznetsov@math.spbu.ru

Editorial Board

Ahmed Al-Jumaily

Institute of Biomedical Technologies Auckland University of Technology Private Bag 92006 Wellesley Campus WD301B Auckland, New Zealand

Fax: +64 9 921 9973

Email:ahmed.al-jumaily@aut.ac.nz

Alexey V. Borisov

Department of Computational Mechanics Udmurt State University, 1

Universitetskaya str., Izhevsk 426034

Russia

Fax: +7 3412 500 295 Email: borisov@ics.org.ru

Albert C.J. Luo

Department of Mechanical and Industrial Engineering Southern Illinois University Edwardsville Edwardsville, IL 62026-1805

USA

Fax: +1 618 650 2555 Email: <u>aluo@siue.edu</u>

Shaofan Li

Department of Civil and Environmental Engineering University of California at Berkeley Berkeley, CA 94720-1710, USA

Fax: +1 510 643 8928 Email: li@ce.berkeley.edu

Antonio M Lopes

UISPA-LAETA/ÎNEGI Faculty of Engineering University of Porto Rua Doutor Roberto Frias, s/n, 4200-465 Porto, Portugal Email:aml@fe.up.pt

Miguel A. F. Sanjuan

Miguel A. F. Sanjuan Department of Physics Universidad Rey Juan Carlos 28933 Mostoles, Madrid, Spain Email: miguel.sanjuan@urjc.es

C. Steve Suh

Department of Mechanical Engineering Texas A&M University College Station, Texas 77843-3123 USA

Fax:+1 979 845 3081 Email: ssuh@tamu.edu

Vasily E. Tarasov

Skobeltsyn Institute of Nuclear Physics Moscow State University 119991 Moscow, Russia Fax: +7 495 939 0397

Email: tarasov@theory.sinp.msu.ru

Giuseppe Catania

Department of Mechanics University of Bologna viale Risorgimento, 2, I-40136 Bologna, Italy

Tel: +39 051 2093447

Email: giuseppe.catania@unibo.it

Riccardo Caponetto

DIEEI, (Electric, Electronics and Computer Engineering Department), Engineering Faculty University of Catania Viale A. Doria 6, 95125 Catania, Italy Email: riccardo.caponetto@dieei.unict.it Liming Dai

Industrial Systems Engineering University of Regina Regina, Saskatchewan Canada, S4S 0A2 Fax: +1 306 585 4855 Email: Liming.Dai@uregina.ca

Mark Edelman

Yeshiva University 245 Lexington Avenue New York, NY 10016, USA Fax: +1 212 340 7788

Email: edelman@cims.nyu.edu

Journal of Applied Nonlinear Dynamics

Volume 8, Issue 3, September 2019

Editors

J. A. Tenreiro Machado

Albert Chao-Jun Luo



Publication Information

Journal of Applied Nonlinear Dynamics (ISSN 2164-6457 (print), eISSN 2164-6473 (online)) is published quarterly (March, June, September, and December) by L & H Scientific Publishing, LLC, P.O. Box 99, Glen Carbon, IL62034, USA. Subscription prices are available upon request from the publisher or from this journal website. Subscriptions are accepted on a prepaid basis only and entered on a calendar year basis. Issues are sent by standard mail (Surface in North America, air delivery outside North America). Priority rates are available upon request. Claims for missing issues should be made within six months of the date of dispatch.

Changes of Address

Send address changes to L&H Scientific Publishing, LLC, P.O. Box 99, Glen Carbon, IL62034, USA. Changes of address must be received at L&H Scientific Publishing eight weeks before they are effective.

Authors Inquiries

For inquiries relative to the submission including electronic submission where available, please visit journal website or contact journal Editors-in-Chief.

Advertising Information

If you are interested in adverting or other commercial opportunities, please email via lhscientificpublishing@gmail.com and your enquiry will be handled as soon as possible.

© 2019 L&H Scientific Publishing, LLC. All rights reserved

L&H Scientific Publishing, LLC requires the authors to sign a Journal Copyright Transfer Agreement for all articles published in L&H Scientific. The Copyright Transfer Agreement is an agreement under which the author retains copyright in the work but grants L& H Scientific Publishing LLC the sole and exclusive right and license to publish the full legal term of copyright.

Authors are responsible for obtaining permission from copyright holders for reproducing any illustrations, tables, figures or lengthy quotations published somewhere previously.

For authorization to photocopy materials for internal or personal use under those circumstances not falling within the fair use provisions of Copyright Act, requests for reprints and translations should be addressed to the permission office of L&H Scientific publishing, LLC via lhscientificpublishing@gmail.com or call: +1-618-402-2267. Permission of the Publisher and payment of a fee are required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and forms of document delivery. Special rates are available for educational institutions to make photocopies for non-profit educational classroom use.

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the publisher is required for resale or distribution outside the institution.

Permission of the Publisher is required to store or use electronically any materials contained in this journal, including any entire or partial article, please contact the publisher for advice. Otherwise, no part of this publication can be reproduced, stored in a retrieval systems or transmitted in any form or by means, electronic, mechanical, photocopying, recording or without prior written permission of the Publisher.

Disclaimer

The authors, editors and publisher will not accept any legal responsibility for any errors or omissions that may be made in this publication. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed in USA on acid-free paper.

Aims and Scope

The interdisciplinary journal publishes original and new research results on applied nonlinear dynamics in science and engineering. The aim of the journal is to stimulate more research interest and attention for nonlinear dynamics and application. The manuscripts in complicated dynamical systems with nonlinearity and chaos are solicited, which includes mathematical theories and methods, physical principles and laws, and computational techniques. The journal provides a place to researchers for the rapid exchange of ideas and techniques in nonlinear dynamics and engineering nonlinearity. Topics of interest include but not limited to

- · Complex dynamics in engineering
- Nonlinear vibration and control
- · Nonlinear dynamical systems and control
- · Fractional dynamics and control
- · Dynamical systems in chemical and bio-systems
- · Economic dynamics and predictions
- · Dynamical systems synchronization
- · Bio-mechanical systems
- Nonlinear structural dynamics
- · Nonlinear multi-body dynamics
- · Multiscale wave propagation in materials
- · Nonlinear rotor dynamics

No length limitations for contributions are set, but only concisely written manuscripts are published. Brief papers are published on the basis of Technical Notes. Discussions of previous published papers are welcome.

Peer Review

Journal of Applied Nonlinear Dynamics adopts the traditional blind-review policy in which the reviewers' names are concealed for submission author(s) for free submission. Each submitted manuscript is reviewed at least two referees in appropriate fields. In addition, the editorial board members' recommendation or established experts' recommendation publication are welcome.

Manuscript Submission Guidelines

Author(s) should submit manuscripts via the website: https://www.editorialmanager.com/JAND/Default.aspx. For any questions, authors can directly contact Editors-in-Chief. Manuscript preparation can follow the sample papers and journal manuscript templates (word file and Latex files), which can be downloaded from the website: https://lhscientificpublishing.com/Journals/JAND-Default.aspx.

Proofs and Electronic Offprints

Authors will receive a PDF proof of their articles and, on publication, electronic offprints of the article.

Open Access

After manuscripts were accepted, author(s) have a right to request the accepted manuscripts published by L&H Scientific publishing with open access, and the author(s) have a responsibility to paying the open access publication fee with US\$60 per page. The copyright is still held by the Publisher. Without any request of the open access publication, the accepted manuscripts are assumed to be published traditionally.

Continued from inside front cover

Xilin Fu

School of Mathematical Science Shandong Normal University Jinan 250014, China Email: xilinfu@gmail.com

Hamid R. Hamidzadeh

Department of Mechanical and Manufacturing Engineering Tennessee State University Nashville, TN37209-1561, USA Email: hhamidzadeh@tnstate.edu

Reza N. Jazar

School of Aerospace, Mechanical and Manufacturing RMIT University Bundoora VIC 3083, Australia Email: reza.jazar@rmit.edu.au

Stefano Lenci

Dipartimento di Ingegneria Civile Edile e Architettura, Universita' Politecnica delle Marche via Brecce Bianche, 60131 ANCONA, Italy Email: lenci@univpm.it

Edson Denis Leonel

Departamento de Física UNESP - Univ Estadual Paulista Av. 24A, 1515 - Rio Claro – SP Brazil - 13.506-900 Fax: 55 19 3534 0009 Email: edleonel@rc.unesp.br

Shijun Liao

Department of Naval Architecture and Ocean Engineering Shanghai Jiaotong University Shanghai 200030, China Fax: +86 21 6485 0629 Email: sjliao@mail.sjtu.edu.cn

C. Nataraj

Department of Mechanical Engineering Villanova University, Villanova PA 19085, USA Fax: +1 610 519 7312

Raoul R. Nigmatullin

Department of Theoretical Physics Kremlevskaiya str.18 Kazan State University, 420008 KAZAN, Tatarstan Russia Email: nigmat@knet.ru

Email: c.nataraj@villanova.edu

Lev Ostrovsky

University of Colorado, Boulder, and University of North Carolina, Chapel Hill, USA

Email: lev.ostrovsky@gmail.com

Richard H. Rand

Department of Mathematics Cornell University Ithaca, NY 14853-1503, USA Fax:+1 607 255 7149 Email: rand@math.cornell.edu

S.C. Sinha

Department of Mechanical Engineering Auburn University Auburn, Alabama 36849, USA Fax: +1 334 844 3307 Email: ssinha@eng.auburn.edu

Jian-Qiao Sun

School of Engineering University of California Merced, 5200 N. Lake Road Merced, CA 95344, USA Fax: +1 209 228 4047 Email: jqsun@ucmerced.edu

József K. Tar

Institute of Intelligent Engineering Systems Óbuda University Bécsi út 96/B, H-1034, Budapest, Hungary Email: tar.jozsef@nik.uni-obuda.hu

Juan J. Trujillo

Department de Análisis Matemático Universidad de La Laguna C/Astr. Fco. Sánchez s/n 38271 La Laguna, Tenerife, Spain Email: jtrujill@ullmat.es

Yuefang Wang

Department of Engineering Mechanics Dalian University of Technology Dalian, Liaoning, 116024, China Email: yfwang@dlut.edu.cn

Mikhail V. Zakrzhevsky

Institute of Mechanics Riga Technical University 1 Kalku Str., Riga LV-1658 Latvia Email: mzakr@latnet.lv

Jiazhong Zhang

School of Energy and Power Engineering Xi'an Jiaotong University Shaanxi Province 710049, China Email: jzzhang@mail.xjtu.edu.cn

Yufeng Zhang

College of Sciences China University of Mining and Technology Xuzhou 221116, China Email: mathzhang@126.com