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

Associated Editors

Dumitru Baleanu

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

Email: dumitru@cankaya.edu.tr

Reza N. Jazar

School of Aerospace, Mechanical and Manufacturing, RMIT University PO Box 71, Bundoora VIC 3083 Australia

Fax: +61 3 9925 6108 Email: reza.jazar@rmit.edu.au

Nikolay V. Kuznetsov

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

Fax:+ 7 812 4286998

Email: kuznetsov@math.spbu.ru

Editorial Board

Ahmed Al-Jumaily

The 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

Jose M. Balthazar

Departamento de Estatística, Matemática Aplicada e Computacional Instituto de Geociências e Ciências Exatas ,UNESP Rio Claro C.P, 13500-230 Rio Claro SP, BRAZIL Email: jmbaltha@rc.unesp.br

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: aluo@siue.edu

Stefano Lenci

Dipartimento di Ingegneria Civile Edile e Architettura, Universita' Politecnica delle Marche via Brecce Bianche, 60131 ANCONA, Italy

Fax: +39 071 2204576 Email: lenci@univpm.it

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

C. Nataraj

Department of Mechanical Engineering Villanova University, Villanova PA 19085, USA

Fax: +1 610 519 7312

Email: c.nataraj@villanova.edu

Miguel A. F. Sanjuan

Department of Physics Universidad Rey Juan Carlos Tulipán s/n 28933 Mostoles, Madrid, Spain

Fax: +34 916647455

Email: miguel.sanjuan@urjc.es

C. Steve Suh

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

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

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

Liming Dai

Industrial Systems Engineering University of Regina Regina, Saskatchewan Canada, S4S 0A2 Fax: +1 306 585 4855

Email: Liming.Dai@uregina.ca

Giuseppe Catania

Department of Mechanics University of Bologna viale Risorgimento, 2, I-40136 Bologna, Italy Tel: +39 051 2093447

Email: giuseppe.catania@unibo.it

Mustapha S. Fofana

Department of Mechanical, Robotics and Manufacturing Engineering Worcester Polytechnic Institute Worcester, MA 01609 **USA**

Fax: +1 508 831 5178, Email: msfofana@wpi.edu

Continued on back materials

Journal of Applied Nonlinear Dynamics

Volume 1, Issue 2, June 2012

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.

© 2012 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.



TITLE

No

ORDER FORM

ISSN

QTY

PRICE(US\$)

Please complete the order form below and send it to our office below. L&H Scientific Publishing, P.O. Box 99, Glen Carbon, IL 62034, USA 1-618-402-2267 (Phone) 1-618-545-9338 (Fax)

Email: lhscientificpublishing@gmail.com

Title Selection

| 3 | | | | |
|---|--------------------|---------------|------|----------|
| 4 | | | | |
| | | | | |
| Methods Of Payment | | | | |
| Please Make Check/Bank Draft l | | • | | |
| Methods of Payment O Check/Bank Draft Enclosed US\$ O MasterCard O Visa | | | | |
| Card No | | | Exp. | Date |
| | Contac | t Information | | |
| Organization: | | | | |
| Name: | | | | |
| Street Address: | | | | |
| (sorry, we cannot deliver to P.O. Box) | | | | |
| City/State/Zip | | | | |
| Country: | | | | |
| Email: | | | | |
| Phone/ Fax: | | | | <u> </u> |
| Date X | Signature X | | | |
| | | | | <u></u> |

L&H Scientific Publishing P.O. Box 99 Glen Carbon IL 62034 USA

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

For manuscript submission, 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 found from the website at 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\$30 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

Erno Keskinen

Department of Mechanics and Design Tampere University of Technology 33101 Tampere, Finland Fax +358 3 3115 2307 Email: erno.keskinen@tut.fi

Gennady A. Leonov

Department of Mathematics and Mechanics St-Petersburg State University 198504, Russia Email: leonov@math.spbu.ru

Clara Ionescu

Department of Electrical Energy Systems and Automation Ghent University Technologiepark 913, Gent-Zwijnaarde B9052 Belgium Email: ClaraMihaela.Ionescu@UGent.be

Neil Popplewell

Department of Mechanical and Manufacturing Engineering University of Manitoba Winnipeg, MB R3T 5V6, Canada Fax: +1 204 275 7507 Email: npopple@cc.umanitoba.ca

Richard H. Rand

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

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

Konstantin A. Lurie

Department of Mathematical Sciences Worcester Polytechnic Institute Worcester, MA, 01609, USA Fax: +1 508 831 5824

Richard L. Magin

Email: klurie@wpi.edu

Department of Bioengineering University of Illinois at Chicago Chicago, Illinois 60607-7052, USA Fax:+1 312 996 5921 Email: rmagin@uic.edu

Raoul R. Nigmatullin

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

Lev Ostrovsky

Zel Technology/NOAA ETL Boulder CO, USA 80305 Fax:+1 303 497 7384 Email: Lev.A.Ostrovsky@noaa.gov

S.C. Sinha

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

Department of Mechanical

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 Fax: +36 1 219 6495 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
Fax: +34 922318195
Email: jtrujill@ullmat.es

Yuefeng 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