

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

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

Associate Editors

J. Awrejcewicz

Department of Automation,
Biomechanics and Mechatronics,
The Technical University of Lodz, 1/15
Stefanowski St., 90-924 Lodz, Poland
Fax: +48 42 631 2225, Email:
awrejcew@p.lodz.pl

Stefano Lenzi

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

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

Dumitru Baleanu

Department of Mathematics and
Computer Sciences
Cankaya University
Balgat, 06530, Ankara, Turkey
Fax: +90 312 2868962
Email: dumitru@cankaya.edu.tr

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. 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

Nikolay V. Kuznetsov

Mathematics and Mechanics Faculty
Saint-Petersburg State University
Saint-Petersburg, 198504, Russia
Fax: +7 812 4286998
Email: kuznetsov@math.spbu.ru

C. Nataraj

Department of Mechanical Engineering
Villanova University, Villanova
PA 19085, USA
Fax: +1 610 519 7312
Email: c.nataraj@villanova.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

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

Giuseppe Catania

Department of Mechanics
University of Bologna
viale Risorgimento, 2, I-40136
Bologna, Italy
Tel: +39 051 2093447
Email: giuseppe.catania@unibo.it

Mark Edelman

Yeshiva University
245 Lexington Avenue
New York, NY 10016, USA
Fax: +1 212 340 7788
Email: edelman@cims.nyu.edu

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

Xilin Fu

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

Journal of Applied Nonlinear Dynamics

Volume 6, Issue 4, December 2017

Editors

J. A. Tenreiro Machado

Albert Chao-Jun Luo



L&H Scientific Publishing, LLC, USA

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 advertising or other commercial opportunities, please email via lhscientificpublishing@gmail.com and your enquiry will be handled as soon as possible.

© 2017 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

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\$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

Juan Luis García Guirao

Department of Applied Mathematics
Technical University of Cartagena
Hospital de Marina 30203, Cartagena,
Spain
Fax: +34 968 325694
E-mail: juan.garcia@upct.es

Hamid R. Hamidzadeh

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

Clara Ionescu

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

Reza N. Jazar

School of Aerospace, Mechanical and
Manufacturing
RMIT University
Bundoora VIC 3083, Australia
Fax: +61 3 9925 6108
Email: reza.jazar@rmit.edu.au

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

Gennady A. Leonov

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

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

Richard L. Magin

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

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

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
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

Luis V. Vazquez

Departamento de Matemática Aplicada
Universidad Complutense de Madrid
28040 Madrid, Spain
Fax: +34 91 3947510
Email: lvazquez@fdi.ucm.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