Discontinuity, Nonlinearity, and Complexity

Honorary Editor

Lev Ostrovsky
University of Colorado, Boulder, and University of North Carolina, Chapel Hill, USA, Email: lev.ostrovsky@gmail.com

Editors

Dimitri Volchenkov
Mathematics & Statistics
Texas Tech University
1108 Memorial Circle, Lubbock, TX 79409, USA
Email: dr.volchenkov@gmail.com

Dumitru Baleanu
Cankaya University, Ankara, Turkey
Institute of Space Sciences, Magurele-Bucharest, Romania
Email: dumitru.baleanu@gmail.com

Yufeng Zhang
College of Sciences
China University of Mining and Technology
Xuzhou, Jiangsu 221116, China
Email: zyfxz@cumt.edu.cn

Associate Editors

Ali Akgül
Siirt University
Faculty of Arts and Science
Department of Mathematics, 56100 Siirt, Turkey
Email: aliakgul@siirt.edu.tr

Eugenio Aulisa
Mathematics & Statistics
Texas Tech University
1108 Memorial Circle
Lubbock, TX 79409, USA
Email: eugenio.aulisa@ttu.edu

Mehmet Onur Fen
Department of Mathematics
TED University
06420 Ankara, Turkey
Email: onur.fen@tedu.edu.tr

Marie-Christine Firpo
Laboratoire de Physique des Plasmas
CNRS UMR 7648, Ecole Polytechnique
91128 Palaiseau cedex, France
Email: marie-christine.firpo@lpp.polytechnique.fr

Amin Jajarmi
Department of Electrical Engineering,
University of Bojnord, P.O. Box, 94531-1339, Bojnord, Iran
Email: a.jajarmi@gmail.com

Ranis N. Ibragimov, PhD
Department of Mathematics
Wilma Horton Science & Technology Hall
Hampton, VA 23668
E-mail: ranis.ibragimov@hamptonu.edu

Jamal-Odysseas Maaita
Department of Physics,
School of Sciences,
Democritus University of Thrace,
Campus, St. Lucas, Kavala, 65404, Greece
email: jmaay@physics.auth.gr

Elbert E.N. Macau
Lab. for Applied Mathematics & Computing,
National Institute for Space Research, Av. dos Astronautas, 1758
C. Postal 515 12227-010 - Sao Jose dos Campos - SP, Brazil
Email: elbert.macau@gmail.com

Sergey Meleshko
School of Mathematics
Suranaree University of Technology
111 University Avenue, Sub District
Suranaree, Muang District, Nakhon Ratchasima 30000, Thailand
E-mail: sergey@math.sut.ac.th

Fuhong Min
School of Electrical & Electronic Engineering, Nanjing Normal University
Xianlin University District
Jiangsu 210023, China
Email: minfuhong@njnu.edu.cn

Carla M. A. Pinto
Instituto Superior de Engenharia do Porto,Department of Mathematics, Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal
Email: cpinto@fc.up.pt

Alexander N. Pisarchik
Center for Biomedical Technology
Technical University of Madrid
Campus Montegancedo
28223 Pozuelo de Alarcon, Madrid, Spain
E-mail: alexander.pisarchik@ctb.upm.es

Miguel A. F. Sanjuan
Nonlinear Dynamics, Chaos and Complex Systems, Universidad Rey Juan Carlos
Tulipán s/n, 28933 Mostoles, Madrid, España-Spain
Email: miguel.sanjuan@urjc.es

Andrey Shilnikov
Neuroscience Institute and Department of Mathematics & Statistics,
Georgia State University, USA
Email: ashilnikov@gsu.edu

C. Steve Suh
Department of Mechanical Engineering
Texas A&M University
College Station, Texas 77843-3123,USA
Email: ssuh@tamu.edu

Hansong Tang
Civil Engineering
The City College of New York
New York, USA
Email: htang@ccny.cuny.edu

Alexei A. Vasiliev
Space Research Institute
Profsoyuznaya 84/32
Moscow 117997, Russia
Email: valex@iki.rssi.ru

Dengshan Wang
Laboratory of Mathematics and Complex Systems (Ministry of Education)
School of Mathematical Sciences
Beijing Normal University
Beijing, 100875, China
Email: dswang@bnu.edu.cn

Continued on back materials

An Interdisciplinary Journal of

Discontinuity, Nonlinearity, and Complexity

Volume 15, Issue 2, June 2026

Editors
Dimitry Volchenkov
Dumitru Baleanu
Yufeng Zhang

L&H Scientific Publishing, LLC, USA

Publication Information

Discontinuity, Nonlinearity, and Complexity (ISSN 2164-6376 (print), eISSN 2164-6414 (online)) is published quarterly (March, June, September, and December) by L & H Scientific Publishing, LLC, PO Box 219, 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, PO Box 219, 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.

© 2026 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 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 results on recent developments, discoveries and progresses on Discontinuity, Nonlinearity and Complexity in physical and social sciences. The aim of the journal is to stimulate more research interest for exploration of discontinuity, complexity, nonlinearity and chaos in complex systems. The manuscripts in 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 discontinuity, complexity, nonlinearity and chaos in physical and social sciences. Topics of interest include but not limited to

- Complex and hybrid dynamical systems
- Discontinuous dynamical systems (i.e., impulsive, time-delay, flow barriers)
- Nonlinear discrete systems and symbolic dynamics
- Fractional dynamical systems and control
- Stochastic dynamical systems and randomness
- Complexity, self-similarity and synchronization
- Complex nonlinear phenomena in physical systems
- Stability, bifurcation and chaos in complex systems
- Turbulence and other complex phenomena in hydrodynamics
- Nonlinear waves and solitons
- Dynamical networks
- Combinatorial aspects of dynamical systems
- Biological dynamics and biophysics
- Pattern formation, social science and complexization

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

Discontinuity, Nonlinearity, and Complexity 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/dnc/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 at https://lhscientificpublishing.com/Journals/DNC-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 Options

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. The copyright is still held by the Publisher, but the open access permission is given to the author(s) as follows. Without any request of the open access publication, the accepted manuscripts are assumed to be published traditionally. This journal offers authors two choices to publish their research.

- *Open access:* Articles are freely available to both subscribers and the wider public with permitted reuse. An open access publication fee is payable by authors or their research funder.
- *Subscription:* Articles are made available to subscribers through our access programs. No open access publication fee.

L&H scientific does offer alternative open access publishing options in accordance with funding body requirements. Your publication choice will have no effect on the peer review process or acceptance of your submission.

Open Access Articles

- User rights

All articles published gold open access will be immediately and permanently free for everyone to read and download. We offer authors a choice of user licenses, which define the permitted reuse of articles. We are continuously working with our author communities to select the best choice of license options, currently being defined for this journal as follows:

Creative Commons Attribution (CC BY): lets others distribute and copy the article, to create extracts, abstracts, and other revised versions, adaptations or derivative works of or from an article (such as a translation), to include in a collective work (such as an anthology), to text or data mine the article, even for commercial purposes, as long as they credit the author(s), do not represent the author as endorsing their adaptation of the article, and do not modify the article in such a way as to damage the author's honor or reputation.

Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND): for non-commercial purposes, lets others distribute and copy the article, and to include in a collective work (such as an anthology), as long as they credit the author(s) and provided they do not alter or modify the article.

- Open access publication fee

To provide open access, this journal has a publication fee which needs to be met by the authors or their research funders for each article published open access. The open access publication fee for this journal is USD 100 per page, excluding taxes.

Self-archiving Policy

Authors can share their research in a variety of different ways. The author(s) can also self-archive their author manuscript immediately and enable public access from their institution's repository after an embargo period. This is the version that has been accepted for publication and which typically includes author-incorporated changes suggested during submission, peer review and in editor-author communications.

An author is entitled to post the accepted manuscript in their institution's repository and make this public after an embargo period (known as self-archiving). The embargo period for this journal can be found below.

Without the L&H permission, the published journal article cannot be shared publicly, such as, on ResearchGate or Academia.edu, to ensure the sustainability of peer-reviewed research in journal publications.

Embargo period: For subscription articles, an appropriate amount of time is needed for journals to deliver value to subscribing customers before a manuscript becomes available for free to the public. This is called an embargo period and it begins from the date the article is formally published online in its final and fully citable form.

This journal has an embargo period of 24 months and the embargo period for the USA is 12 months.

Continued from inside front cover

Guo-Cheng Wu
Key Laboratory of Intelligent Analysis and Decision on Complex Systems,
Chongqing University of Posts and Telecommunications,
Chongqing, 400065, China
Email: wuguocheng@gmail.com

Siyuan Xing
Department of Mechanical Engineering
California Polytechnic State University San Luis, Obispo, CA, 93401, USA
Email: siyuanxing9132@gmail.com

Mei-qin Zhan
Department of Mathematics and Statistics
College of Arts and Sciences
University of North Florida,
Jacksonville, FL32224, USA
Email:mzhan@unf.edu

Editorial Board

Mokhtar Adda-Bedia
Laboratoire de Physique Statistique
Ecole Normale Supérieure
24 rue Lhomond, 75231 Paris Cedex 05, France
Email: adda@lps.ens.fr

Ravi P. Agarwal
Department of Mathematics
Texas A&M University – Kingsville,
Kingsville, TX 78363-8202, USA
Email: agarwal@tamuk.edu

Igor Belykh
Department of Mathematics & Statistics
Georgia State University
30 Pryor Street, Atlanta, GA 30303-3083 USA
Email: ibelykh@gsu.edu

Didier Bénisti
CEA, DAM, DIF 91297 Arpajon Cedex France
Email: didier.benisti@cea.fr

Alexandre N. Carvalho
Departamento de Matem´atica, Instituto de Ci^encias Matem´aticas e de Computa¸c˜ao Universidade de S˜ao Paulo - Campus de S˜ao Carlos, Caixa Postal 668, 13560-970 S˜ao Carlos SP, Brazil
Email: andcarva@icmc.usp.br

Jipeng Cheng
College of Sciences
China University of Mining and Technology
Xuzhou, Jiangsu 221116, China
Email: chengjp@cumt.edu.cn

Maurice Courbage
CNRS-UMR 7057 "Matière et Systèmes Complexes", 75205 Paris Cedex 13 France
Email: maurice.courbage@univ-paris-diderot.fr

Michal Feckan
Department of Mathematical Analysis and Numerical Mathematics, Comenius University
Mlynska dolina
842 48 Bratislava, Slovakia
Email: michal.feckan@fmph.uniba.sk

Stefano Galatolo
Dipartimento di Matematica Applicata
Via Buonattoti 1
56127 Pisa, Italy
Email: s.galatolo@ing.unipi.it

Xavier Leoncini
Centre de Physique Théorique, Aix-Marseille Université, CPT Campus de Luminy, Case 907
13288 Marseille Cedex 9, France
Email: leoncini@cpt.univ-mrs.fr

Yuri Maistrenko
Institute of Mathematics
National Academy of Sciences of Ukraine
Volodymyrska Str. 54, room 232
01030 Kiev, Ukraine
E-mail: y.maistrenko@biomed.kiev.ua

Mikhail Malkin
Department of Mathematics and Mechanics
Nizhny Novgorod State University, Nizhny Novgorod, Russia
Email: malkin@unn.ru

Vladimir I. Nekorkin
Institute of Applied Physics of RAS
46 Ul'yanov Street, 603950, Nizhny Novgorod, Russia
Email: vnekorkin@neuron.appl.sci-nnov.ru

Raul Rechtman
Centro de Investigacion en Energia
Universidad Nacional Autonoma de Mexico
Priv. Xochicalco S/N, Temixco
Morelos 62580, Mexico
Email: rrs@cie.unam.mx

Nikolai Rulkov
BioCircuits Institute, University of California, San Diego, 9500 Gilman Drive #0328 La Jolla, CA 92093-0328, USA
Email: nrulkov@ucsd.edu

Vasily E. Tarasov
Skobeltsyn Institute of Nuclear Physics
Moscow State University
119992 Moscow, Russia
Fax: +7 495 939 03 97
Email: tarasov@theory.sinp.msu.ru

Marco Thiel
Institute for Mathematical Biology and Complex Systems
University of Aberdeen
AB243UE Aberdeen, Scotland, UK
Email: m.thiel@abdn.ac.uk

Vladimir V. Uchaikin
Ulyanovsk State University
L.Tolstoy Str. 42
Ulyanovsk 432700, Russia
Email: vuchaikin@gmail.com

Edgardo Ugalde
Instituto de Fisica
Universidad Autonoma de San Luis Potosi
Av. Manuel Nava 6, Zona Universitaria
San Luis Potosi SLP
CP 78290, Mexico
Email: gallo.ugalde@gmail.com

Haifeng Wang
School of Science,
Jimei University
Xiamen, 361021, China
Email: tb19080005b4@cumt.edu.cn

Todd Young
Department of Mathematics
Ohio University
Athens, OH 45701, USA
Email: young@math.ohiou.edu