PROCEEDINGS OF SPIE

Health Monitoring of Structural and Biological Systems XVIII

Zhongqing Su Kara J. Peters Fabrizio Ricci Piervincenzo Rizzo Editors

25–28 March 2024 Long Beach, California, United States

Sponsored by SPIE

Co-sponsored by RDI Technologies, Inc. (United States)

Published by SPIE

Volume 12951

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in *Health Monitoring of Structural and Biological Systems XVIII*, edited by Zhongqing Su, Kara J. Peters, Fabrizio Ricci, Piervincenzo Rizzo, Proc. of SPIE 12951, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510672086

ISBN: 9781510672093 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2024 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

ix Conference Committee

	MOND AV VEVNOTE
	MONDAY KEYNOTE
12951 03	Microscale actuation using acoustofluidics for rapid micromanipulation and 3D printing (Keynote Paper) [12951-1]
	SPECIAL SESSION: GUIDED WAVES FOR SHM AND NDE I
12951 04	Effect of bending modes on failure analysis of adhesively bonded composite structures [12951-2]
12951 05	Flow-coating of adhesively bonded optical fiber acoustic couplers [12951-3]
12951 06	Laser ultrasonic inspection of lithium-ion battery wire welding [12951-4]
12951 07	Damage detection in structures using SH waves sensed with FBG sensors [12951-5]
	SPECIAL SESSION: GUIDED WAVES FOR SHM AND NDE II
12951 08	Guided ultrasonic wave measurement in plates using low-cost equipment [12951-6]
12951 09	Identification of local debonding in bolted panels using nonlinear pseudo-forces [12951-7]
12951 OB	Studying the elastic wave mode propagation in D-shaped optical fibers [12951-9]
12951 0C	Towards a FRF-based parametric surrogate for guided wave-based evaluation in multiple defect scenarios [12951-10]
12951 OD	Wave propagation analysis in composite plate with clapping delamination based on spectral element method $[12951\text{-}11]$
	SPECIAL SESSION: GUIDED WAVES FOR SHM AND NDE III
12951 OF	Residual stress evaluation of multilayer viscoelastic composites using guided wave and electromechanical impedance signal feature variations [12951-13]

12951 OG	Distinctive trembling features following resonance peaks at zero group velocity frequencies in harmonic analysis [12951-14]
12951 OH	A hybrid PZT-FBG sensing-based damage detection [12951-15]
	ADDITIVE MANUFACTURING AND AI-DRIVEN SHM I
12951 OJ	Dynamic shape memory alloy driven magnetic latch system [12951-17]
12951 OK	Digital twin in the real-time ultrasonic assessment of additively manufactured PLA parts [12951-18]
12951 OL	Inspection of wind turbine blades using image deblurring and deep learning segmentation [12951-42]
	SPECIAL SESSION: NDE AND SHM OF BATTERY MATERIALS, STRUCTURES, AND SYSTEMS
12951 OM	Ultrasonic detection of pre-existing thermal abuse in lithium-ion pouch cells [12951-20]
12951 00	Characterizing the structure of lithium metal batteries using local ultrasonic resonance spectroscopy (LURS) [12951-22]
12951 0Q	Exploratory investigation of early detection for high-C discharge-induced failure in 18650 lithium-ion batteries [12951-25]
	SPECIAL SESSION: PHONONIC CRYSTALS AND ACOUSTIC/ELASTIC METAMATERIALS
12951 OU	Boundary effect on in-gap edge states in nonlocal Su-Schrieffer-Heeger model [12951-29]
12951 0V	An overview of geometric phases in elastic systems and their connection to topological invariants of elastic metamaterials [12951-30]
12951 OW	Direction-dependent elastic wave scattering and mode coupling in elastic plates [12951-31]
	TUESDAY KEYNOTE
12951 OX	Passive ultrasonic sensing for NDT and SHM (Keynote Paper) [12951-32]

RECENT ADVANCES IN SHM I

12951 OY	Numerical simulation of fast multiple acoustic sources localization on a spherical surface [12951-33]
12951 OZ	Enhancing dynamics measurement from moving cameras through sensor-fusion motion compensation approaches [12951-34]
12951 10	Physics-guided data-driven failure identification of underwater mooring systems in offshore infrastructures [12951-35]
12951 11	Damage detection in 3D-printed plate using the electromechanical impedance method with surface bonded and embedded sensors [12951-53]
	RECENT ADVANCES IN SHM II
12951 12	A signal energy-based acoustic source localization technique for composite laminates [12951-36]
12951 13	Assessing structural health via measurements of attractor deformation [12951-37]
12951 14	Interaction of Lamb waves and sensors in structural health monitoring of carbon fiber composite [12951-38]
12951 15	Non-probabilistic reliability model for structural damage identification under uncertainty with reduced model [12951-39]
12951 16	Experimental validation of guided wave mode conversion at part-thickness defects in metal plates [12951-40]
12951 17	Automated transducer deployment for Lamb wave-based nondestructive evaluation of plates [12951-83]
	BIOMEDICAL APPLICATIONS AND DEVICES I
12951 18	Using acoustic emissions to enhance rodent locomotion analysis in an open field [12951-45]
12951 1A	Thickness measurement of metal components using guided waves and fully non-contact PL-SLDV system [12951-49]
	BIOMEDICAL APPLICATIONS AND DEVICES II
12951 1B	Enhancing rodent behavior analysis in an open field arena with acoustic emissions: the setup and scope [12951-46]

12951 1C	Predicting intraocular pressure utilizing highly nonlinear solitary waves as inputs to a CNN [12951-47]
	ADDITIVE MANUFACTURING AND AI-DRIVEN SHM II
12951 1F	Deep learning-based prediction of interfacial conditions in coated plates using guided waves [12951-43]
12951 1H	Condition monitoring of intelligent tires utilizing 1D CNN and vibration measurement [12951-101]
	RECENT ADVANCES IN SHM III
10051.11	
12951 11	Comparison between a novel compressed sensing-based neural network and traditional neural network approaches for electrical impedance tomography reconstruction [12951-54]
12951 1K	Comparative study of Al-enabled damage detection strategies based on story drifts and stiffness reductions for seismically-excited building [12951-56]
12951 1L	A non-destructive method for underwater material flexural modulus measurement [12951-58]
12951 1M	Acoustic streaming effects on collagen self-assembly [12951-59]
12951 1N	Electro-mechanical impedance measurements in space environment with miniaturized hardware [12951-60]
	SIGNAL AND IMAGING PROCESSING
12951 10	Passive ultrasonic beamforming for fast and efficient imaging [12951-61]
12951 1P	Design and investigation of polymer-based terahertz nearfield imaging probes for the high-resolution nondestructive imaging applications [12951-62]
12951 1Q	Improvements on focused tactile feedback using time reversal mirror (Best Student Paper Award 1st Place) [12951-63]
12951 1R	Edge computing-based imagery data preprocessing strategy [12951-64]
12951 1\$	Integrating recurrent neural network (RNN) and Navier-Stokes equations for noncontact blood pressure assessment [12951-65]

SPECIAL SESSION: RECENT ADVANCES IN NONLINEAR ULTRASONICS-BASED NDE AND SHM

12951 1V	Numerical modeling with experimental verification investigating the effects of nonlinearities on the sideband peak count-index technique and topological acoustic sensing [12951-68]
12951 1W	Modulation transfer technique for damage detection of structures [12951-69]
	SENSORS AND ENERGY HARVESTING
12951 1Z	Dynamic deployment sensing of thin-shell composite structures with fiber Bragg gratings [12951-72]
12951 20	Automated real-time satellite docking monitoring using piezoelectric wafer transducers [12951-73]
	SPECIAL SESSION: 3D-PRINTED SENSORS
12951 21	Two-photon 3D printed active polymer ring resonators on the tip of optical fibers for temperature sensing [12951-75]
12951 22	Fiber-optic temperature sensor based on embedded rare-earth luminescent nanoparticles [12951-76]
12951 23	All-printed multifunctional sensors for structural health monitoring of inflatable habitats (Best Student Paper Award 2nd Place) [12951-77]
	SPECIAL SESSION: OPTICAL SENSING AND MACHINE LEARNING FOR SHM AND NDE
12951 25	Natural pattern tracking for 3D-digital image correlation measurements [12951-79]
12951 26	Parametric study on the accuracy of full-field reconstruction from sparse measurements using autoencoders [12951-80]
12951 27	A laser-based quality control of screw penetration in mass timber connections [12951-81]
	RECENT ADVANCES IN SHM IV
12951 29	Notch characterization in pipes from the scattering of helical-guided ultrasonic waves [12951-57]
12951 2A	Normal data-based motor fault diagnosis using stacked time-series imaging method [12951-99]

12951 2B Feature-based template approach for optimizing digital image correlation on complex **deformations** [12951-85] **ADVANCED MODELING** 12951 2C Transfer function models for using empirical and physics-based simulation signal response data [12951-87] 12951 2D Mapping reliably detectable dye penetrant crack size at external corners with fillet radii [12951-88] 12951 2E An entropy-based probabilistic model for acoustic emission RA-value-average frequency data (Best Student Paper Award 3rd Place) [12951-89] 12951 2F Time integration with proper generalized decomposition for efficient time response analysis in nonlinear dynamical systems [12951-90] **POSTER SESSION** 12951 2G Spatial imaging for impact-induced damages in LiFePO₄ battery via active sensing network [12951-91] Micro-size damage detection of multilayer ceramic capacitors based on Hilbert-Huang 12951 2H transform of electromechanical responses [12951-92] 12951 21 From structure health monitoring to forensics: adapting computer vision to support victims of violence [12951-93] 12951 2L Multimodal NDT inspection and characterization of composite honeycomb sandwich samples with programmed flaws [12951-96] **DIGITAL POSTER SESSION** 12951 20 The feasibility study of the real-time evaluating the total hip replacement (THR) by using acoustic emission [12951-51] 12951 2P Temperature simulation method for tower tube of an offshore wind turbine support structure [12951-86]