

PROCEEDINGS OF SPIE

# ***Soft Mechatronics and Wearable Systems***

**Ilkwon Oh  
Sang-Woo Kim  
Maurizio Porfiri  
Woon-Hong Yeo**  
*Editors*

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

*Sponsored and Published by*  
SPIE

**Volume 12948**

Proceedings of SPIE 0277-786X, V. 12948

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

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 [SPIDigitalLibrary.org](http://SPIDigitalLibrary.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 *Soft Mechatronics and Wearable Systems*, edited by Ilkwon Oh, Sang-Woo Kim, Maurizio Porfiri, Woon-Hong Yeo, Proc. of SPIE 12948, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510672024

ISBN: 9781510672031 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://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](http://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.

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**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

vii *Conference Committee*

---

## WEARABLE TECHNOLOGIES I

---

12948 03 **A novel in situ hemocompatibility enhancement in endovascular devices through arterial pulsation-driven surface modification** [12948-3]

---

## WEARABLE TECHNOLOGIES II

---

12948 04 **Cardiovascular health monitoring using multiple conformal photoplethysmography devices** [12948-7]

12948 05 **A novel fusion method for intense heat detection and localization solely based on surface temperature with multimode DEA feedback** [12948-8]

---

## WEARABLE TECHNOLOGIES III

---

12948 06 **Soft wireless at-home sleep wearables for the clinical assessment of sleep quality and sleep apnea (Invited Paper)** [12948-10]

12948 07 **Flexible sensor and energy harvesting technology based on ferroelectret for the acquisition of mechanical and physiological parameters close to the body** [12948-11]

---

## SOFT ROBOTICS I

---

12948 09 **Multimodal motion of soft origami tripod using electrohydraulic actuator** [12948-22]

---

## SOFT ROBOTICS II

---

12948 0A **3D-manufactured soft haptic actuators utilizing electrostatically driven pneumatic valves** [12948-27]

---

## ENERGY DEVICES II

---

12948 OB **Animal hair based triboelectric generators and sensors (Invited Paper)** [12948-34]

---

## BIOMEDICAL APPLICATIONS I

---

12948 OC **Wireless vascular bioelectronic systems with printed soft sensors and flexible electronic stents**  
[12948-42]

---

## BIOMEDICAL APPLICATIONS II

---

12948 OD **Mechano-luminescence-optoelectronic strain sensing strips for health monitoring wearables**  
[12948-44]

12948 OE **Detecting impaired movements of stroke patients in bimanual training from motion sensor data**  
[12948-47]

---

## BIOMEDICAL APPLICATIONS III

---

12948 OF **Automating the assessment of wrist motion in telerehabilitation with haptic devices** [12948-40]

---

## FUNCTIONAL MATERIALS AND CONVERGENCE TECH

---

12948 OG **Single-electron driven chip size near infrared free-electron laser** [12948-58]

---

## POSTER SESSION

---

12948 OH **New electronic health telemetry device (Stakecare) applied in the monitoring and controlling falls of individuals** [12948-59]

12948 OI **Development of unit cell model for prediction of large deformation in SMA-textile base actuator** [12948-62]

12948 OJ **Pantograph structure based self-powered force sensor** [12948-63]

12948 OK **Capacitor-based self-powered sound sensor for enhanced electrical output** [12948-65]

12948 OL **A novel low-profile deployable and retrievable epidural lead array system** [12948-66]

- 12948 OM **Accelerating electro-ionic soft actuators by feedforward control and the performance degradation by voltage limits** [12948-67]
- 12948 ON **Wireless soft multifunctional biopatch for preventing heat-related illness of construction workers** [12948-72]
- 12948 OO **Developing a novel 2D electro-optic scanner for potential micro display and head mounted display application** [12948-76]
- 12948 OP **Heat exchanger performance simulation and demonstration for thermoelectric power generation system** [12948-78]