

FINAL PROGRAM

2022

SOLID-STATE SENSORS, ACTUATORS AND MICROSYSTEMS WORKSHOP

HILTON HEAD

Sonesta Resort ★ Hilton Head, South Carolina

June 5-9, 2022



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PROGRAM-AT-A-GLANCE

Monday, June 6

7:00 am	Breakfast
7:45 am - 8:15 am	Welcome
8:15 am - 8:55 am	Plenary Speaker I - Lawrence Poree University of California, San Francisco, USA
8:55 am - 10:15 am	Session 1 - Point-of-Use Sensing Systems
10:15 am - 10:44 am	Break and Tabletop Inspection
10:44 am - 10:45 am	Wen Ko Technical Leadership Award Announcement
10:45 am - 11:15 am	Invited Speaker I - Alicia Chong Rodriguez Bloomer Tech, USA
11:15 am - 12:15 pm	Session 2 - Next-Generation Design and Prototyping
12:15 pm - 12:45 pm	Poster Preview - Session 1
12:45 pm - 2:15 pm	Networking Lunch
2:15 pm - 4:45 pm	Poster Session 1 - Contributed and Late News

Tuesday, June 7

7:30 am	Breakfast		
8:10 am - 8:15 am	Announcements		
8:15 am - 8:55 am	Plenary Speaker II - Mina Sartipi University of Tennessee, Chattanooga, USA		
8:55 am - 9:55 am	Session 3 - Acoustic Devices and Microsystems		
9:55 am - 10:24 am	Break and Tabletop Inspection		
10:24 am - 10:25 am	Denice Denton Mentorship Award Announcement		
10:25 am - 10:55 am	Invited Speaker II - Leslie Field, Bright Ice Initiative, Inc., SmallTech Consulting, LLC, and Stanford University, USA		
10:55 am - 11:55 am	Session 4 - High-FOM Resonators		
11:55 am - 1:30 pm	Networking Lunch		
2:00 pm - 6:00 pm	Early Career Faculty Development Session 2:00 pm - 4:00 pm	MSIG Industry Session: Sensorization Journey 2:00 pm - 4:00 pm	Recreational Activities
4:00 pm - 7:00 pm	Graduate Student Networking Event		
7:00 pm - 10:00 pm	Banquet		

Wednesday, June 8

7:15 am - 8:15 am	Women in MEMS Breakfast
7:30 am	Breakfast
8:10 am - 8:15 am	Announcements
8:15 am - 8:55 am	Plenary Speaker III - Carl E. McCants DARPA, USA
8:55 am - 10:15 am	Session 5 - Physical and Environmental Sensors
10:15 am - 10:44 am	Break and Tabletop Inspection
10:44 am - 10:45 am	Mark Shannon Grand Challenges Award Announcement
10:45 am - 11:15 am	Invited Speaker III - Sawyer B. Fuller University of Washington, USA
11:15 am - 12:15 pm	Session 6 - Ingestible and Implantable Microsystems 1
12:15 pm - 1:00 pm	Poster Preview - Session 2
1:00 pm - 2:30 pm	Networking Lunch
2:30 pm - 5:00 pm	Poster Session 2 - Contributed and Late News
5:00 pm - 6:30 pm	Free Time
6:30 pm - 8:00 pm	Poster Session 3 and Reception Invited Open Posters, Commercial, & Open Posters
8:00 pm - 10:00 pm	Rump Session

Thursday, June 9

7:30 am	Breakfast
8:10 am	Announcements
8:15 am - 8:55 am	Plenary Speaker IV - Tony Y. Hu Tulane University, USA
8:55 am - 9:55 am	Session 7 - Ingestible and Implantable Microsystems 2
9:55 am - 10:25 am	Break and Tabletop Inspection
10:25 am - 10:55 am	Invited Speaker IV - Victor Acosta University of New Mexico, USA
10:55 am - 11:55 am	Session 8 - Late News
11:55 am - 12:10 pm	TRF Celebrations
12:10 pm - 12:45 pm	Award Ceremony and Closing Remarks
12:45 pm - 2:15 pm	Networking Lunch
2:15 pm	Workshop Adjourns

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All photos Courtesy of the Hilton Head Island Visitor & Convention Bureau

GENERAL INFORMATION

Masks

Even though the Sonesta Resort does not require face masks, we ask all Workshop attendees and guests to wear a mask regardless inside all meeting space except when eating and drinking.

Wireless Internet Service

Wireless Internet will be available in the Workshop meeting space in the Sonesta Resort.

- Select "**Sonesta Guest**" from the list of available networks
- Scroll down to the third option "**Connect with Access Code**"
- Enter "**HiltonHead**" (case sensitive) and select "Connect"



We ask that you limit your usage to be considerate of other attendees and please logout once you are finished. There is a bandwidth limit of 2 Mbps per device.

Meeting Room Logistics

Please contact the Workshop Registration Desk if you find the temperature in the room uncomfortable or you are unable to hear or see because of equipment difficulties.

Name Badges

All attendees, and their guests, must wear their name badge at all times to gain admission to all sessions and social functions.

Job Board

The Job Board will be located near the Workshop Registration Desk.

Chimes

The chimes will ring five minutes before the end of each scheduled break. The sessions will begin on time, so please return to the meeting room when you hear the chimes.

Hilton Head on Social Media

Don't forget to follow and tag us on our social media platforms.



Please be courteous and don't share unauthorized photos, defamatory statements, et cetera.

GUEST PACKAGES

Guest meal packages are available for purchase for all guests of attendees. The package includes the Sunday Welcome Reception, Guest Breakfast (Jasper Room, Second Floor, Monday - Thursday, 7:30 a.m. – 10:00 a.m.), Lunches, and the Tuesday Banquet. Please visit the Workshop Registration Desk if you would like to purchase a guest package. Guests and children will not be admitted to social events without a badge. A name badge is required for anyone to attend the meal functions. Children under 6 are free but require a name badge. Please register them as well if you have not already done so.

SOCIAL EVENTS

Name badges are required for all Social Events, including guests and children.

Sunday Welcome Reception

The Welcome Reception will be held Sunday evening, 6:00 p.m. - 9:00 p.m. outside in the Pavilion.

Tuesday Banquet

The Banquet will be held on Tuesday evening, 7:00 p.m. - 10:00 p.m. outside in the Pavilion and is sponsored in part by:



All attendees and guests will need to pick-up a banquet ticket at the conference registration desk on Tuesday prior to the banquet. You will need to show proof (photo) of a negative COVID test taken on Tuesday afternoon to receive a ticket. Entrance to the banquet will not be allowed without a negative test. Tickets will be distributed starting at 4:00 pm.

Beach Volleyball

The Beach Volleyball tournament, sponsored by Analog Devices, will be held on Tuesday afternoon between 2:00 p.m. and 6:00 p.m. All levels of play will be integrated into this fun afternoon. Analog Devices will be supplying refreshments, so come out and play, or just come watch the fun. If you are interested in joining, we would appreciate it if you would sign-up at the Workshop Registration Desk so we can get a headcount for refreshments.



Women in MEMS Breakfast

The Women in MEMS Breakfast will be on Wednesday from 7:15 a.m. - 8:05 a.m. in the Savannah Jr. Ballroom. Come meet new faces, catch up with old friends, and make connections. Students and first-time attendees are especially encouraged to attend and join the Women in MEMS Network. Breakfast will be served in the room.

HILTON HEAD 2022

Student Events



THE STUDENT LOUNGE



The student lounge will be available throughout the workshop in the Dorchester Room on the second floor. You can visit the lounge whenever you need a break from the regular conference programming. Bring your coffee to the lounge and chat with other students. As this room will not be monitored by hotel staff, we ask that you be respectful of others and pick-up after yourself.



STUDENT TABLES



During lunch on Monday and Wednesday, we will have reserved tables in the outdoor pavilion for students to network and socialize.



BEACH COMPETITIONS



Join us Tuesday afternoon on the beach for Sandcastle Building or in the Student Lounge to participate in the Buoyancy Challenge!

For these events, you'll form teams of students from different universities and compete for prizes!



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to check out the
full rules on our
Facebook Group



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THE TRANSDUCER RESEARCH FOUNDATION (TRF) is a nonprofit organization whose mission is to stimulate research in science and engineering, with emphasis on technologies related to transducers, microsystems, and nanosystems, and to foster the exchange of ideas and information between academic, industrial, and government researchers.

TRF sponsors conferences, workshops, seminars, and short courses in the microsystems industry such as this Hilton Head Workshop which has been held here at Hilton Head since its inception in 1984. The spirit of these TRF meetings is to provide ample opportunities for discussion and networking along with a technical track of the highest quality. All proceeds raised during their sponsored events go back into the conference for future years and to scholarship funds to enable student travel and participation at various conferences throughout the world. TRF considers student participation at these conferences a key element to the success of the meetings and the growth of the microsystems industry. Training, mentoring, networking, idea exchange, and furthering the research and development interests for sensors, actuators, and microsystems are among the objectives of these meetings. Student participation is essential to accomplish these objectives.

TRF welcomes inquiries from groups who wish to apply for TRF sponsorship of proposed topical Workshops and Conferences that are consistent with the TRF mission. If your organization would like to explore any of these options for TRF sponsorship or student travel grants, please contact a TRF Officer/Director, or by contacting us at info@transducer-research-foundation.org for further information.

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COMMERCIAL SUPPORT

Special acknowledgement to the Transducer Research Foundation, Inc. for their educational grant funding support of this Workshop.



<http://www.transducer-research-foundation.org>

The Transducer Research Foundation, Inc. would also like to thank the following companies for their support, encouragement, and involvement in the 2022 Solid State Sensors, Actuators, and Microsystems Workshop.

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The MEMS and Sensors Industry Group (MSIG) is a leading group of 150+ companies throughout the ecosystem who collaborate and share ideas to help ease the adoption of MEMS and sensors. Check out our website to learn more about how MSIG can help your company grow and prosper. By joining MSIG, members benefit from: - Connecting with companies across the global MEMS and sensors supply chain. - Proliferating knowledge about sensor technology, use cases, and manufacturing capabilities. - Advancing technology through government R&D funding. - Fostering company collaboration through working groups and standards committees. - Identifying industry gaps and promoting innovative solutions through events, webinars and blogs.



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University of Florida - Interdisciplinary Microsystems Group

200 Benton Hall, 968 Center Drive
Gainesville, FL 32611 USA
phone: 352-392-0911
<https://www.ufl.edu/>



Founded in 1998, the Interdisciplinary Microsystems Group (IMG) is a college-wide multi-departmental education and research program of the Herbert Wertheim College of Engineering at the University of Florida. IMG research focuses on micro- and nanosystems for healthcare, energy, security, aerospace, transportation, consumer electronics, and other industries. Efforts include design, fabrication, characterization, and ultimately deployment of micro and nanotechnologies for a wide variety of applications.

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Actuators (ISSN 2076-0825; CODEN: ACTUC3) is an international open access journal on the science and technology of actuators and control systems published by MDPI, Basel, Switzerland. It is published under the scientific leadership of a well-recognized Editorial Board and has been indexed by many important databases, including Science Citation Index Expanded - Web of Science (Clarivate Analytics), Scopus (Elsevier), Inspec (IET), etc.

MDPI - Sensors Journal

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Microtech Ventures is focused on strategic venture capital, angel investing, and M&A advisory services. Our mission is to accelerate the development of MEMS, sensors, microfluidics, LOC devices, and microtechnologies for the advancement of civilization and creation of market value. Microtech Ventures fulfills the need for companies in the industry to turn to a knowledgeable entity capable of identifying and orchestrating high value, mutually beneficial deals.

MEMS and Nanotechnology Exchange

1895 Preston White Drive
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engineering@mems-exchange.org
www.mems-exchange.org



The MEMS and Nanotechnology Exchange (MNX) has been providing design and fabrication services to the United States research and business communities since 1999.

Tabletop Exhibitors

EXHIBITORS

TABLE

A.M. Fitzgerald & Associates LLC 3

700 Airport Blvd, Suite 270
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phone: 1-650-347-6367
info@amfitzgerald.com
www.amfitzgerald.com

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CoventorMP® is the industry-leading MEMS design software used to create innovative accelerometers, gyroscopes, pressure sensors, microphones, actuators, micro mirrors, microbolometers, switches, resonators, and more. It's employed in the automotive, aerospace, industrial, defense, and consumer electronics industries, in applications such as smartphones, autonomous vehicles, and IoT devices. Predict the success of your MEMS design prior to time-consuming and costly fabrication.

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Evatec	12
13577 Feather Sound Drive, Suite 300 Clearwater, FL 33762 USA phone: 1-727-201-4313 info@evatecnet.com www.evatecnet.com	

Evatec's latest thin film production solutions help you unlock your future. New generation CLUSTERLINE® tools equipped with single or batch process module technology give you the flexibility to configure platforms with etch, PVD, PECVD or PEALD for the widest flexibility in the years ahead. New clustered BAK evaporation solutions drive down cost of ownership in thin film processes for wireless and MEMS applications.

Geegah	11
350 Duffield Hall Praxis Center for Venture Development Ithaca, NY 14853 USA phone: 1-607-351-2066 amit@geegah.com www.geegah.com	

Geegah offers a 128x128 2GHz ultrasonic imager, alongside a PC or Web based Graphical User Interface. The user can control frequency, sampling time, region of interest and can image bacteria, tissue, organisms such as nematodes (*C. elegans* included), fluid and solid properties. Geegah is also developing a piezo-MEMS on CMOS process to be available as MPW runs.

Heidelberg Instruments Inc.	16
2539 W. 237th Street, Suite A Torrance, CA 90505 USA phone: 1-310-212-5071 info@heidelberg-instruments.com heidelberg-instruments.com	

Heidelberg Instruments is a world leader in the development and production of high-precision laser lithography systems, maskless aligners and nanofabrication tools.

IEEE Sensors Council	8
445 Hoes Lane Piscataway, NJ 08854 USA ieee-sensors.org	

The IEEE Sensors Council promotes research, development, awareness, and use of sensors broadly. Activities emphasize disseminating the technical aspects of sensors, from theory, design, fabrication, and manufacturing to application of devices for sensing and transducing physical, chemical, and biological phenomena by sponsoring accessible international conferences and publications, distinguished lectures, and local chapters.

EXHIBITORS

TABLE

i-ROM GmbH	4
Neukirchen, Saxony 09221 GERMANY	
phone: +49-152-0475-5433	
jan.mehner@i-rom.de	
www.i-rom.de	

i-ROM is the new generation of MEMS design software. Simply draw the sensor, similar to a CAD system, click, and the complete structure with all parameters is recorded in the i-ROM MODELBUILDER. Comprehensive model libraries with standard and user-defined comb cells and parallel plate capacitors support the model input. The MODELBUILDER enables static, harmonic, and transient analysis. Even complicated models with several mass bodies, arbitrary spring shape, and capacitive transducers can be modeled in a very short time. The models are fully parametric and also take into account the manufacturing tolerances such as mask undercuts and etch sidewall slopes, electromechanical interactions and non-linearities. Interface to ANSYS and SIMULINK as well as a mask export to complete the i-ROM MODELBUILDER and make it a "must have" for every MEMS development department.

KLA Corporation	10
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info@kla-tencor.com	
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LioniX International	6
PO Box 456	
Enschede, 7500 THE NETHERLANDS	
phone: +31-53-20-30-053	
info@lionix-int.com	
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LioniX International develops and produces customized MEMS solutions, including process development, mask design and prototyping, from proof-of-principle devices through medium-volume production.

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phone: +41-24-552-0420	
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National Nanotechnology Coordinated Infrastructure (NNCI)	15
345 Ferst Drive	
Atlanta, GA 30332 USA	
phone: 1-404-385-0276	
info@ien.gatech.edu	
nnci.net	

The National Nanotechnology Coordinated Infrastructure (NNCI) is a partnership of academic nanotechnology user facilities that provide state-of-the-art equipment, staff expertise, and training to nanotechnology researchers.

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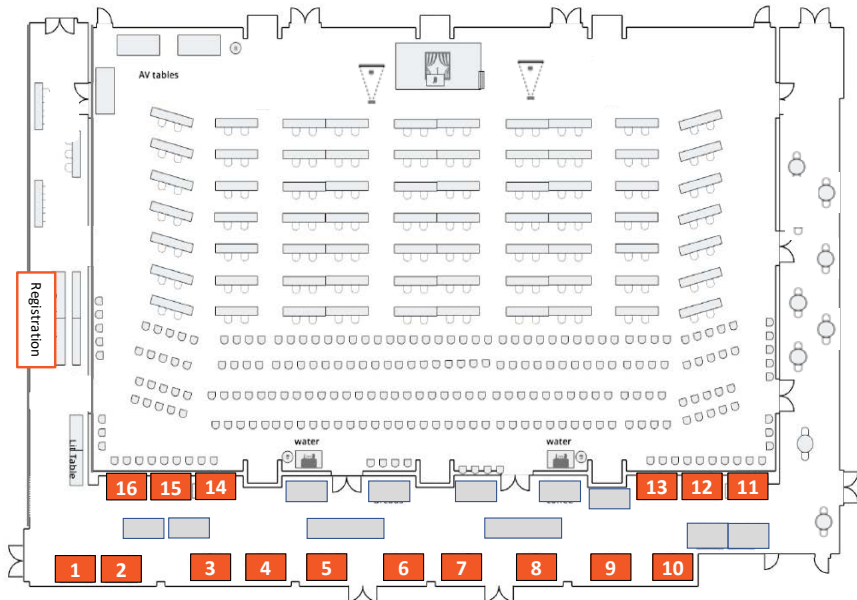
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Tabletop Floor Plan

Santee Ballroom Foyer



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AWARDS

DENICE DENTON MENTORSHIP AWARD

The Hilton Head Workshop is pleased to announce the 2022 Denice Denton Mentorship Award. This award recognizes long-term mentors with a proven record of mentoring researchers and engineers in the areas of interest to TRF.

The award is given in honor of Denice Denton (1959 - 2006), who earned her BS, MS and PhD in electrical engineering from the Massachusetts Institute of Technology, and then went on to a groundbreaking career in academia.

She was the first female engineer to receive tenure as a faculty member at the University of Wisconsin - Madison. At age 37 she was appointed Dean of Engineering at the University of Washington, one of the youngest as well as the first female dean of a top-ranked engineering program. While at UW, she was awarded the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. At 45 she was selected as the Chancellor of the University of California, Santa Cruz, the youngest and the first openly gay person to be appointed as Chancellor in the University of California system.



Denton was a prolific and influential mentor who not only supported colleagues but also remedied the marginalization of those not in positions of privilege and power, using strategies she developed while surmounting daunting professional obstacles of her own. She founded and sustained informal, lively peer support groups, made connections to advocates in positions of power, sought out and shared information about institutional procedures, and even helped with fundraising for legal fees in some cases. She lived out her ideal of institutions in which people could thrive personally as well as professionally.

In a speech to the National Academies, former Dept. of Health and Human Services Secretary Donna Shalala said of Denton, "She was bigger than life. She opened doors, and stood in them to let others through."

AWARDS (continued)

MARK SHANNON GRAND CHALLENGES AWARD

The Hilton Head Workshop is pleased to announce the 2022 Mark Shannon Grand Challenges Award. This award recognizes the long-term contributions of members of our technical community with a vision to address humanity's pressing issues.

The award is given in honor of Mark A. Shannon (1955 - 2012), who earned his BS, MS, and PhD degrees at the University of California, Berkeley, and was on the Mechanical and Systems Engineering faculty of the University of Illinois Urbana-Champaign.

Shannon was renowned for developing nanoscale, microscale, and mesoscale technologies that addressed the grand challenges of water purification and desalination, micro-fabrication, medicine, and energy production. His mission was to bring attention to and solve challenges with the world's highly vulnerable freshwater resources. To this end, he invented new micro- and nano-fabrication methods that utilize electric fields, plasmas, and chemistry to create new NEMS, MEMS, and mesoscale energetic devices and water purification systems. In particular, he was co-inventor of a "molecular gate" that can move and filter materials at the molecular level.



A pillar of our Hilton Head community, his international reputation and passion for his work was evident whether he was teaching students or testifying before Congress, and his energy and tenacity attracted others from around the world to share his vision and work to solve society's problems. By his side always was his wife Mona--the first and only love of his life--including at numerous Hilton Head meetings where she warmly created community. For those lucky enough to work with or know him, Shannon was best known for an unbridled enthusiasm for life, dedication and love for his family, and devotion to his students, even while gravely ill with amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease. In commemorating Shannon's passing, former UIUC Department Head Placid Ferreira shared: "A true visionary, Mark was an extraordinary person who dedicated his work and efforts to our students. He was an inspiration to all of us, and we will always remember his generosity and strength."

AWARDS (continued)

WEN KO TECHNICAL LEADERSHIP AWARD

The Hilton Head Workshop is pleased to announce the 2022 Wen Ko Technical Leadership Award. This award recognizes researchers with an outstanding track-record of technical leadership and innovation in areas of interest to the TRF.

The award is given in honor of Wen Hsiung Ko (1923 - 2017), a member of the Electrical Engineering faculty of Case Western Reserve University (CWRU) from 1959 to his retirement in 1993.

A native of mainland China, Ko moved to Taiwan in the late 1940s and then to Cleveland in 1954, where he earned both his MS (1956) and PhD (1959) from the Case Institute of Technology.



An innovator in both electrical and biomedical engineering, he was a pioneer in microsensors, actuators, integrated microsystems, medical implants, telemetry and packaging. His body of work on physical and chemical (gas) microsensors in the early 1970s is one of the earliest efforts in the field. In the mid-1960s, his group demonstrated the first implantable muscle control system in living subjects.

A light to generations of young engineers, he advised more than 150 MS and PhD students. He established and led the Electronics Design Center at CWRU and was a Fellow of IEEE Biomedical Engineering Society and the American Institute of Medical and Biological Engineering. He was one of the founders of the Transducers Research Foundation and the Hilton Head Workshop series and served as TRF president from 1987 to 2004.

After retirement, Ko remained a research-active emeritus professor for another 11 years, serving as PI on an NIH R21 grant at the age of 89! Ko's children noted, "His spirit and intellect continued to be strong and curious up to the end."

AWARDS (continued)

BENCH-TO-MARKET AWARD

The Hilton Head Workshop is pleased to announce the 2022 Bench-to-Market Award. Building on the successful experience of the MEMS Shark Pup Tank, this award is given to a team of young researchers (students or recent graduates) with solid plans to turn their research into innovative products that could visibly impact the global economy in 5-7 years.

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Microsystems & Nanoengineering is an open access and fully peer-reviewed journal which publishes original articles and reviews on cutting-edge and emerging topics related to MEMS/ NEMS and nanotechnology. The Journal is the first engineering journal initiated by Nature Publishing Group (now part of Springer Nature) and Chinese Academy of Sciences in 2014. The Journal is abstracted & indexed by SCIE, Ei, PubMed Central, Scopus, DOAJ, etc. The 2020 impact factor is 7.127 (Q1). The number of days in Year 2020 from Submission to acceptance is 143 days.

STUDENT TRAVEL AWARDS

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AWARDS (continued)

STUDENT TRAVEL AWARDS (continued)

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SPECIAL EVENTS

SUNDAY SHORT COURSE PROGRAM: TRANSLATING INNOVATION

Sunday - 10:30 p.m. - 3:30 p.m. - Savannah Jr. Ballroom

The "Translating Innovation" Sunday Workshop will center on the commercialization of microsystems technologies. The program will include speakers and panelists spanning start-up and established companies, such as Meta (Facebook), Verily (Alphabet), PARC (Xerox), CELLINK (BiCo), IndieBio, AgZen, LiteraSeed, and Berkeley Lights. From networking sessions, presentations, and interactive panels, Sunday Workshop participants will gain unique insights into the challenges and successes in microtechnology translation, such as CRISPR-based diagnostics, miniaturized biotechnology, and agricultural microsystems.

SEMI - MSIG INDUSTRY SESSION: SENSORIZATION JOURNEY

Tuesday - 2:00 p.m. - 4:00 p.m. - Savannah Jr. Ballroom

The MEMS and Sensors Industry Group (MSIG) is pleased to bring their Sensorization Journey to Hilton Head 2022. This exciting and informative session will cover topics including students moving to industry, prototypes moving to production, and sensors moving to new markets.

EARLY CAREER FACULTY DEVELOPMENT SESSION

Tuesday - 2:00 p.m. - 4:00 p.m. - Santee Ballroom

For the first time since the inaugural Hilton Head Workshop in 1984, we are offering a special session on early career faculty development. This session, targeting senior graduate students, postdocs, and junior faculty members in our community, aims to offer relevant guidance and advice for new faculty as well as those who aspire to become faculty members.

WEDNESDAY RUMP SESSION: UN-ZOOMING Hilton Head!

Wednesday - 7:00 p.m. - 10:00 p.m. - Santee Ballroom

We will take an opportunity to reengage our colleagues face to face, while providing a refresher on some of the finer points of actual in person human interaction. After far too many years apart, we hope that this event will allow you to catch up with old colleagues, as well as to create an environment for you to network and make new colleagues. The organizing committee hopes that you will also learn some new facts about micro manufacturing in the first half of the session. Additionally, given the long time span since we have last gathered (Moore's Law is unrelenting), we hope that the second half of the rump session will allow the microsystems community to engage in stimulating conversation on the future of our field, the future direction of the global microsystems supply chain, and the future of in person technical meetings.

Sunday, June 5

10:30 am - **Short Course Morning – Translating Innovation**

12:00 pm Networking and Presentations

1:00 pm - **Short Course Afternoon – Translating Innovation**

3:30 pm Panel Discussions

6:00 pm - **Registration and Welcome Reception**

9:00 pm

Monday, June 6

7:00 am **Breakfast**

7:45 am **Welcome**

TRF President - Thomas W. Kenny, *Stanford University*

Workshop Chair - Reza Ghodssi, *University of Maryland*

Program Chair - Jenna Chan, *DEVCOM Army Research Laboratory*

Plenary Speaker I

Session Chair: Swami Rajaraman, *University of Central Florida, USA*

8:15 am **MICROSENSOR MEASUREMENT OF EVOKED COMPOUND ACTION POTENTIALS IMPROVES SPINAL CORD STIMULATION CLINICAL EFFECTIVENESS AND LONG TERM EFFICACY**

Lawrence Poree

University of California, San Francisco, USA

Session 1: Point-of-Use Sensing Systems

Session Chairs: Daniela Diaz-Alonso, *CIDESI, MEXICO*

Gymama Slaughter, *Old Dominion University, USA*

8:55 am **A PASSIVE WIRELESS DIFFERENTIAL SENSOR FOR IN-SITU EARLY DETECTION OF PERIPROSTHETIC JOINT INFECTION**

Jiaxin Jiang, Krithika Sureshkumar, Chandrashekhar Choudhary, Tristan Kerkes, H. Claude Sagi, Chia-Ying Lin,

Michael T. Archdeacon, and Tao Li

University of Cincinnati, USA

9:15 am SALIVA-BASED SARS-COV-2 SELF-TESTING WITH RT-LAMP IN A MOBILE DEVICE (SLIDE)

Zifan Tang, Jiarui Cui, Aneesh Kshirsagar, Tianyi Liu,
and Weihua Guan
Pennsylvania State University, USA

9:35 am EARLY DETECTION OF SIMULATED HERBIVORE ATTACKS IN SORGHUM FIELDS THROUGH THE DEPLOYMENT OF VERY-LOW-POWER GAS SENSOR NETWORK

Shakir-ul Haque Khan¹, Sayali Tope¹, Mohit Karkhanis¹,
Bryan Hatasaka¹, Seungbeom Noh¹, Rana Dalpati¹,
Ashrafuzzaman Bulbul¹, Ravi V. Mural², Aishwaryadev Banerjee¹,
Kyeongheon Kim³, James C. Schnable², Mingyue Ji¹,
Carlos Mastrangelo¹, Ling Zang¹, and Hanseup Kim¹
¹*University of Utah, USA*, ²*University of Nebraska, Lincoln, USA*, and
³*Gyeongsang National University, KOREA*

9:55 am MULTIPLEXING AND INCREASING THE THROUGHPUT OF "ROLOSENSE ASSAY" UTILIZING COST-EFFECTIVE WIFI IMAGING AND DISPOSABLE MICROFLUIDICS CHIPS FOR SARS-COV-2 DETECTION

Jorge Manrique Castro¹, Frank Sommerhage², Selma Piranej³,
David DeRoo², Khalid Salaita³, and Swaminathan Rajaraman^{1,2}
¹*University of Central Florida, USA*, ²*Primordia Biosystems, USA*,
and ³*Emory University, USA*

10:15 am Break and Tabletop Inspection

10:44 am Wen Ko Technical Leadership Award Announcement

Invited Speaker I

Session Chair: Raji Baskaran, *Manifolds Lab, USA*

10:45 am PERSONALIZED MEDICINE FOR OFTEN OVERLOOKED POPULATIONS BY USING TEXTILE-BASED SENSORS

Alicia Chong Rodriguez
Bloomer Tech, USA

Session 2: Next-Generation Design and Prototyping

Session Chairs: Alba Avila, University at Los Andes, COLOMBIA
Kris Dorsey, *Northeastern University, USA*

11:15 am **RAPID PROTOTYPING OF 3D PRINTED MEMS ARRAYS ON FLEXIBLE SUBSTRATES**

Regan Kubicek, Sukjun Kim, and Sarah Bergbreiter
Carnegie Mellon University, USA

11:35 am **A HYBRID 3D MICRO-NANOPRINTING APPROACH FOR BIOMEDICAL MICROINJECTION NEEDLE ARRAYS**

Sunandita Sarker¹, Adira Colton¹, Ziteng Wen¹, Xin Xu¹,
Piotr Walczak², Mirosław Janowski², Yajie Liang²,
and Ryan D. Sochol¹

¹*University of Maryland, College Park, USA, and*

²*University of Maryland, School of Medicine, USA*

11:55 am **TOWARDS A CMOS INTEGRATED PIEZOELECTRIC MEMS PROCESS DESIGN KIT**

Benyamin Davaji^{1,2}, Justin Kuo^{1,3}, Matteo Rinaldi², and Amit Lal^{1,3}

¹*Cornell University, USA, ²Northeastern University, USA, and*

³*Geegah LLC, USA*

12:15 pm **Poster Preview – Session 1**

Session Chair:

Kirsten Kaplan, *Facebook, USA*

12:45 pm - **Networking Lunch**

2:15 pm

Poster Session 1

2:15 pm **Contributed and Late News**

See page 13 for listing of poster presentations

4:45 pm **End of Day**



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Tuesday, June 7

7:30 am Breakfast

8:10 am Announcements

Plenary Speaker II

Session Chair: Vladimir Aksyuk, *National Institute of Standards and Technology (NIST), USA*

8:15 am SENSORS THAT MAKE COMMUNITY SENSE

Mina Sartipi

University of Tennessee, Chattanooga, USA

Session 3: Acoustic Devices and Microsystems

Session Chair: Azadeh Ansari, *Georgia Institute of Technology, USA*

8:55 am PERIOD TRIPLING STATES AND NON-MONOTONIC ENERGY DISSIPATION IN COUPLED MEMS RESONATORS

Mingkang Wang^{1,2}, Diego J. Perez-Morelo^{1,2}, Daniel Lopez^{3,1}, and Vladimir A. Aksyuk¹

¹*National Institute of Standards and Technology (NIST), USA,*

²*University of Maryland, USA, and*

³*Pennsylvania State University, USA*

9:15 am HETEROGENEOUS INTEGRATION FOR HYBRID ACOUSTIC DEVICES: GAN/CU/YIG MAGNETOELASTIC HBARS

Vikrant J. Gokhale¹, Brian P. Downey¹, Pallavi Dhagat²,

Albrecht Jander², Shawn Mack¹, D. Scott Katzer¹,

Jason A. Roussos¹, and David J. Meyer¹

¹*US Naval Research Laboratory, USA and*

²*Oregon State University, USA*

9:35 am UNDERWATER ACOUSTIC TWEEZERS CAPABLE OF TRAPPING LARGE AND HEAVY PARTICLES

Kianoush Sadeghian Esfahani, Yongkui Tang, Jaehoon Lee, Matin Barekatain, and Eun S. Kim

University of Southern California, Los Angeles, USA

9:55 am Break and Tabletop Inspection

10:24 am Denice Denton Mentorship Award Announcement

Invited Speaker II

Session Chair: Nima Ghalichechian, *Georgia Institute of Technology, USA*

10:25 am ADDRESSING THE GRAND CHALLENGES OF CLIMATE CHANGE

Leslie Field

Bright Ice Initiative, Inc., SmallTech Consulting, LLC and Stanford University, USA

Session 4: High-FOM Resonators

Session Chair: Hengky Chandralim, *Air Force Institute of Technology, USA*

10:55 am HIGHEST FIGURE OF MERIT MICROACOUSTIC RESONATORS FOR MID-BAND 6G SPECTRUM

Gabriel Giribaldi, Michele Pirro, Meruyert Assylbekova,
Luca Colombo, and Matteo Rinaldi
Northeastern University, USA

11:15 am X-BAND FERROELECTRIC-ON-SI FIN BULK ACOUSTIC RESONATORS (FOS-FINBAR) WITH $f \cdot Q$ OF 0.8×10^{13}

Faysal Hakim and Roozbeh Tabrizian
University of Florida, USA

11:35 am POWER HANDLING CHALLENGES OF HIGH K_T^2 ALSCN LAMB WAVE RESONATORS

Mingyo Park, Yue Zheng, and Azadeh Ansari
Georgia Institute of Technology, USA

11:55 pm Networking Lunch

1:30 pm

Early Career Faculty Development Session

Chair: Svetlana Tatic-Lucic, *Lehigh University, USA*

**2:00 pm - Benjamin Griffin¹, Jenica Patterson², Stephen Senturia³,
4:00 pm Usha Varshney⁴, Ryan Sochol⁵, Roozbeh Tabrizian⁶,
and Kris Dorsey⁷**

¹Defense Advanced Research Projects Agency (DARPA), USA,

²National Institutes of Health (NIH), USA, ³Massachusetts Institute of Technology, Emeritus, USA and ⁴National Science Foundation (NSF), USA, ⁵University of Maryland, USA,

⁶University of Florida, USA, and ⁷Northeastern University, USA,

2:00 pm - MSIG Industry Session: Sensorization Journey

4:00 pm Savannah Jr. Ballroom

2:00 pm Intro & Industry Update

Tim Brosnihan

SEMI MEMS and Sensors Industry Group, USA

2:20 pm Emerging Leaders

Tzeno Galchev, *Analog Devices, USA*

Thomas Li, *NXP, USA*

2:50 pm Lab-to-Fab Journey

Mary Ann Maher, *SoftMEMS, USA*

Michelle Bourke, *LAM Research, USA*

3:10 pm Bench-to-Market (B2M) Competition

3:40 pm Sensorization for Smart Cities

Tim Brosnihan, *SEMI MEMS and Sensors Industry Group, USA*

Austin Harris, *Center for Urban Informatics and Progress, USA*

Stephen Bart, *TDK-InvenSense, USA*

2:00 pm - Recreational Activities (on your own)

7:00 pm

4:00 pm - Graduate Student Networking Event

7:00 pm

7:00 pm - Banquet

10:00 pm

All attendees and guests will need to pick-up a banquet ticket at the conference registration desk on Tuesday prior to the banquet. You will need to show proof (photo) of a negative COVID test taken on Tuesday afternoon to receive a ticket. Entrance to the banquet will not be allowed without a negative test. Tickets will be distributed starting at 4:00 pm.

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Wednesday, June 8

7:15 am **Women in MEMS Breakfast** (Savannah Jr. Ballroom)

7:30 am **Breakfast**

8:10 am **Announcements**

Plenary Speaker III

Session Chair: Juliet Gopinath, *University of Colorado, Boulder, USA*

8:15 am **MANUFACTURING NEXT-GENERATION MICROELECTRONICS**

Carl E. McCants

Defense Advanced Research Projects Agency (DARPA), USA

Session 5: Physical and Environmental Sensors

Session Chair: Sina Askari, *ECS/DARPA, USA*

8:55 am **A MEMS MICROVALVE FOR THE SPACECRAFT ATMOSPHERE MONITOR (SAM) INSTRUMENT**

Cecile Jung-Kubiak, Risaku Toda, Abhijit Shevade, M. Bulut Coskun, Sofia Rahiminejad, Matthew Dickie, Cliff Frez, John Gill, and Mina Rais-Zadeh

California Institute of Technology, USA

9:15 am **EXPLOITING NONLINEAR PROPERTIES OF VO₂ IN A MMWAVE ANTENNA-COUPLED SENSOR**

Shangyi Chen¹, Mark Lust², and Nima Ghalichechian³

¹University of Pennsylvania, USA, ²Ohio State University, USA, and

³Georgia Institute of Technology, USA

9:35 am **KILOVOLT PYROELECTRIC VOLTAGE GENERATION AND ELECTROSTATIC ACTUATION WITH FLUIDIC HEATING**

Di Ni, Ved Gund, Landon Ivy, and Amit Lal

Cornell University, USA

9:55 am **A HIGH-Q SOLID DISK BAW GYROSCOPE IN MONOCRYSTALLINE 4H SILICON-CARBIDE WITH SUB-PPM AS-BORN FREQUENCY SPLIT**

Zhenming Liu, Ardalan Lotfi, Michael P. Hardin, and Farrokh Ayazi

Georgia Institute of Technology, USA

10:15 am Break and Tabletop Inspection

10:44 am Mark Shannon Grand Challenges Award Announcement

Invited Speaker III

Session Chair: Jennifer Talley, *Air Force Research Laboratory, USA*

10:45 am BIOLOGY-INSPIRED INTELLIGENCE IN THE DESIGN, CONTROL, AND POWER SYSTEMS OF INSECT-SIZED FLYING ROBOTS

Sawyer B. Fuller

University of Washington, Seattle, USA

Session 6: Ingestible and Implantable Microsystems 1

Session Chairs: Luke Beardslee, *Emory University and Georgia Institute of Technology, USA*

Spyridon Pavlidis, *North Carolina State University, USA*

11:15 am MINIATURIZED CAPSULE SYSTEM FOR HYDROGEN SULFIDE DETECTION IN THE GASTROINTESTINAL TRACT

Justin M. Stine, Santiago Botasini, Luke A. Beardslee, Joshua A. Levy, and Reza Ghodssi

University of Maryland, College Park, USA

11:35 am BIOPOWER-IN-GUT: AN INGESTIBLE BACTERIA-POWERED BATTERY CAPSULE

Maryam Rezaie, Zahra Rafiee, and Seokheun Choi

State University of New York, Binghamton, USA

11:55 am MONITORING OF PHYSIOLOGICAL FLOW WITH A MICROFABRICATED ELECTROCHEMICAL PARYLENE FLOW SENSOR

Xuechun Wang¹, Trevor Hudson¹, Kee Scholten¹, Elliot Myong¹, J. Gordon McComb², and Ellis Meng¹

¹*University of Southern California, Los Angeles, USA and*

²*Children's Hospital Los Angeles, USA*

12:15 pm Poster Preview – Session 2

Session Chair: Behraad Bahreyni, *Simon Fraser University, USA*

1:00 pm - Networking Lunch
2:30 pm

Poster Session 2

2:30 pm **Contributed and Late News**

See page 21 for listing of poster presentations

5:00 pm - **Free Time**

Poster Session 3 and Reception

6:30 pm **Commercial and Open Posters**

See page 29 for listing of poster presentations

8:00 pm - **Rump Session - Un-Zooming Hilton Head!**

10:00 pm Chair: Robert “Chris” Roberts, *University of Texas, El Paso, USA*



Thursday, June 9

7:30 am Breakfast

8:10 am Announcements

Plenary Speaker IV

Session Chair: Amit Lal, *Cornell University, USA*

8:15 am PROBING THE LIFE IN BUBBLES – NANOPLASMONIC QUANTIFICATION OF PATHOGEN-DERIVED EXTRACELLULAR VESICLES IN BLOOD

Tony Y. Hu

Tulane University, USA

Session 7: Ingestible and Implantable Microsystems 2

Session Chairs: Kevin Daniels, *University of Maryland, USA*

Carol Livermore, *Northeastern University, USA*

8:55 am PASSIVE 3D-PRINTED FULLY ELASTIC PILL FOR SAMPLING OF GUT MICROBIOME

Ruben Del-Rio-Ruiz, Cihan Asci, Rachel Owyung,
Giovanni Widmer, and Sameer Sonkusale

Tufts University, USA

9:15 am BIOMIMETIC ANCHORING SYSTEM FOR SUSTAINED AND LOCALIZED GASTROINTESTINAL DRUG DELIVERY

Joshua A. Levy, Michael A. Straker, Luke A. Beardslee,
and Reza Ghodssi

University of Maryland, College Park, USA

9:35 am NON-INVASIVE SMART CAPSULE FOR CONTINUOUS MONITORING OF INFLAMMATORY BOWEL DISEASE

Sachin Kadian, Vidhya Selvamani, Sina Nejati, and Rahim Rahimi
Purdue University, USA

9:55 am Break and Tabletop Inspection

Invited Speaker IV

Session Chair: Roozbeh Tabrizian, *University of Florida, USA*

10:25 am **DIAMOND QUANTUM SENSORS**

Victor Acosta

University of New Mexico, USA

Session 8: Late News

Session Chair: Vikrant Gokhale, *Naval Research Laboratory, USA*

10:55 am **GIANT NON-RECIPROCITY THROUGH FREQUENCY MODULATION OF A TWO DEGREE-OF-FREEDOM MICROMECHANICAL RESONATOR**

James M.L. Miller¹, Jianing Zhao¹, Chae Hyuck Ahn², Eldwin J. Ng², Vu Hong², Yushi Yang², Nicholas E. Bousse², Thomas W. Kenny², and Gaurav Bahl¹

¹*University of Illinois, Urbana-Champaign, USA and*

²*Stanford University, USA*

11:15 am **PCB-BOT: THE FIRST STEPS OF A 4 MG LEGGED MICROROBOT**

Sukjun Kim, Regan Kubicek, and Sarah Bergbreiter
Carnegie Mellon University, USA

11:35 am **SCALABLE FABRICATION OF ACTIVE NANOGAPS WITH SUB-NANOMETER TUNABILITY FOR NANOSCALE SENSORS AND ACTUATORS**

Weikun Zhu, Peter F. Satterthwaite, and Farnaz Niroui
Massachusetts Institute of Technology, USA

11:55 am **TRF Celebrations**

12:10 pm **Award Ceremony**

Chair: Behraad Bahreyni, *Simon Fraser University, USA*

12:30 pm **Closing Remarks**

Workshop Chair - Reza Ghodssi, *University of Maryland*

Program Chair - Jenna Chan, *DEVCOM Army Research Laboratory*

12:45 pm - **Networking Lunch**

2:15 pm

2:15 pm **Workshop Adjourns**

Poster Presentations - Session 1

Contributed and Late News Posters
Monday, June 6 2:15 pm – 4:45 pm

Chemical or Biological Sensors, Actuators or Systems

- MP-01 A STRETCHABLE NEURAL INTERFACE FOR VAGUS NERVE STIMULATION: FABRICATION AND ELECTROCHEMICAL CHARACTERIZATION**
Jongcheon Lim¹, Matthew P. Ward^{1,2}, John B. Furness³, Luis C. Populin⁴, and Hyowon Lee¹
¹Purdue University, USA, ²Indiana University School of Medicine, USA, ³University of Melbourne, AUSTRALIA, and ⁴University of Wisconsin, Madison, USA
- MP-02 AN EQUIPMENT-FREE PAPERTRONIC SENSING SYSTEM FOR POINT-OF-CARE MONITORING OF ANTIMICROBIAL SUSCEPTIBILITY**
Zahra Rafiee, Maryam Rezaie, Olya Noruz Shamsian, and Seokheun Choi
State University of New York, Binghamton, USA
- MP-03 CMOS-NANOWELL BASED HYBRID SMART BANDAGE FOR LONG TERM MONITORING OF WOUND HEALING VIA CYTOKINE QUANTIFICATION IN-SITU**
Chengjie Zhu¹, Pengfei Xie², Ryan Thorpe¹, Jesus Maldonado¹, Suneel Kumar², Aaron Mazzeo², Mehdi Javanmard², Francois Berthiaume², and Kaushik Sengupta¹
¹Princeton University, USA and ²Rutgers University, USA
- MP-04 DROPBLOT DESIGN INTEGRATES DROPLET MICROFLUIDICS WITH SINGLE-CELL ELECTROPHORESIS FOR TARGETED PROTEOMICS**
Yang Liu and Amy E. Herr
University of California, Berkeley, USA
- MP-05 FIELD-DEPLOYABLE MICROFLUIDIC IMMUNOASSAY DEVICE FOR PROTEIN DETECTION**
Gihoon Choi, Betty Mangadu, Yooli K. Light, and Robert J. Meagher
Sandia National Laboratories, USA
- MP-06 HYDROGEL ACTUATED MICRONEEDLE (HAM) WOUND PATCH**
Rebecca Campbell¹, Jun Ying Tan², Alanis Santiago¹, Jungkwun Kim², and Albert Kim¹
¹Temple University, USA and ²Kansas State University, USA

- MP-07 UV-BASED, IN-SITU, LOW POWER, WIRELESS SOIL CARBON MEASUREMENT SYSTEM**
Steven Tran, Rabiul Hasan, Ashrafuzzaman Bulbul, Seungbeom Noh, Carlos Mastrangelo, and Hanseup Kim
University of Utah, USA
- MP-08 LEAF-MOUNTED MICRONEEDLE-BASED MULTISENSORY PLATFORM FOR MULTIPLEXED MONITORING OF PHYTOHORMONES IN LIVE PLANTS**
Nafize I. Hossain and Shawana Tabassum
University of Texas, Tyler, USA
- MP-09 POLYMER AND STAINLESS STEEL-BASED 3D MICROELECTRODE ARRAYS (3D MEAS), WITH PENTA-MODAL SENSING CAPABILITIES FOR THE INVESTIGATION OF ELECTROGNIC CELLS**
Charles M. Didier¹, Julia Freitas Orrico¹, Omar S. Cepeda-Torres^{1,2}, Aliyah Baksh¹, Jorge Manrique Castro¹, and Swaminathan Rajaraman¹
¹*University of Central Florida, USA and*
²*Polytechnic University of Puerto Rico, PUERTO RICO*
- MP-10 PROGRAMMABLE MAGNETIC ROBOT (PROMAGBOT) FOR AUTOMATED NUCLEIC ACID EXTRACTION AT THE POINT OF NEED**
Anthony J. Politza, Tianyi Liu, and Weihua Guan
Pennsylvania State University, USA
- MP-11 3D-PRINTED CAPSULE FOR SAMPLING LOWER DIGESTIVE TRACT MICROBIOTA**
Sina Nejati, Sotoudeh Sedaghat, Nicole Balog, and Rahim Rahimi
Purdue University, USA
- MP-12 SOFT INJECTABLES USING SMART THREADS FOR DOSE-CONTROLLED DRUG DELIVERY**
Mossab K. Alsaedi, Riddha Das, Hojatollah Rezaei Nejad, Atul Sharma, and Sameer Sonkusale
Tufts University, USA
- MP-13 TOWARDS DETERMINISTIC LATERAL DISPLACEMENT-BASED CONTINUOUS-FLOW MICROFLUIDIC PARTICLE REACTORS VIA DIRECT LASER WRITING**
Adira Colton¹, Olivia M. Young¹, Talha Razaulla², Roseanne Warren², and Ryan D. Sochol¹
¹*University of Maryland, College Park, USA and*
²*University of Utah, Salt Lake City, USA*

- MP-14 UTILIZATION OF VARYING TRANSIENT RESPONSE TIMES IN GRAVIMETRIC AND IMPEDIMETRIC MULTIVARIATE GAS SENSOR WITH SINGLE POLYMERIC SENSING FILM FOR ENHANCED SELECTIVITY**
Steven A. Schwartz¹, Luke A. Beardslee^{1,2,3}, and Oliver Brand¹
¹Georgia Institute of Technology, USA, ²Naval Submarine Medical Research Laboratory, USA, and ³Emory University, USA

Physical Sensors, Actuators, or Systems

- MP-15 A 7 GHZ ACOUSTICALLY COUPLED FILTER WITH INTRINSIC SWITCHABILITY USING FERROELECTRIC SCANDIUM-ALUMINUM NITRIDE**
Sushant Rassay, Dicheng Mo, and Roozbeh Tabrizian
University of Florida, USA
- MP-16 A FLEXIBLE ORIGAMI OPTO-ELECTRO ARRAY FOR IN VIVO OPTOGENETIC STIMULATION AND ELECTROPHYSIOLOGY RECORDINGS FROM DORSAL ROOT GANGLION**
Yan Gong, Liu Xiang, and Wen Li
Michigan State University, USA
- MP-17 A SC_{0.28}AL_{0.72}N LAMINATED BULK ACOUSTIC WAVE RESONATOR WITH SELF-OVEN-CONTROLLED SWITCHABILITY**
Shaurya Dabas, Dicheng Mo, Sushant Rassay, and Roozbeh Tabrizian
University of Florida, USA
- MP-18 AN ACCURATE TEMPERATURE REGULATING SCHEME BASED ON A RESISTOR WITH TAILORED NONLINEARITY FOR EVAPORATIVE DRUG DELIVERY**
Frank Goldschmidtboeing¹, Mohammadreza Saberi¹, Timo Gerach¹, Luca Conrad¹, Eiko Hager¹, Uttunga Shinde¹, Muhannad Ghanam¹, Uwe Pelz¹, Niklas Romming², Lasse Cornils², Jan Jaklin², Marc Kessler², and Peter Woias¹
¹University of Freiburg, GERMANY and ²Hauni Maschienenbau GmbH, GERMANY
- MP-19 LASER-INDUCED GRAPHENE PRESSURE SENSORS MANUFACTURED VIA INKJET PCB PRINTER**
Landon Ivy¹, Ved Gund¹, Benyamin Davaji^{1,2}, Carlos Ospina³, Di Ni¹, Peter Doerschuk¹, and Amit Lal¹
¹Cornell University, USA, ²Northeastern University, USA, and ³BotFactory Inc., USA

- MP-21 ETCH-HOLE FREE, LARGE GAP WAFER SCALE ENCAPSULATION PROCESS FOR MICROELECTROMECHANICAL RESONATORS**
 Gabrielle D. Vukasin¹, Nicholas E. Bousse², Anne L. Alter³,
 and Thomas W. Kenny²
¹Bosch LLC, USA, ²Stanford University, USA, and ³Apple, USA
- MP-22 IMPACT OF ASPECT RATIO ON VOLTAGE GAIN OF QUARTZ TRAPPED-ENERGY RESONATORS**
 Mary E. Galanko Klemash¹, Dylan Bruno², Tobias M. Kiebal²,
 Ryan Rudy¹, Victor Farm-Guoo Tseng¹, and Sarah S. Bedair¹
¹Army Research Laboratory, USA and ²Rochester Institute of Technology, USA
- MP-23 LARGE TILT-ANGLE PHOTOTHERMAL OPTICAL BEAM STEERING USING MICROPATTERNED CNT-BASED INFRARED ABSORBER ON MULTILAYER THIN FILM STRUCTURES**
 Harris J. Hall¹, Sean A. McDaniel¹, Fahima Ouchen^{1,2},
 Jose L. Figueroa^{1,2}, David Torres¹, Piyush J. Shah^{1,3},
 Emily M. Heckman¹, and LaVern Starman¹
¹Air Force Research Laboratory, USA, ²KBR, Inc., USA, and ³Apex Microdevices, USA
- MP-24 LOW POWER 38.4 MHZ MEMS BASED REFERENCE CLOCK FOR QUARTZ REPLACEMENT WITH LESS THAN 30 PPM FREQUENCY STABILITY**
 Sarah Shahraini¹, Timo Huusari¹, Somnath Kundu¹, Hao Luo¹,
 Parvin Akhkandi², Yasaman Majd², Eduardo Alban¹, Brent Carlton¹,
 Ruth Vidana Morales¹, Jason Mix¹, Reza Abdolvand²,
 Mohamed Abdelmoneum¹, and Nasser Kurd¹
¹Intel, USA and ²University of Central Florida, USA
- MP-25 MAGNETOHYDRODYNAMIC PROPULSION FOR MICRO ROBOTS**
 Ethan Leong and Camilo Velez
University of California, Irvine, USA
- MP-26 MICRO ENERGY HARVESTER USING ACOUSTICALLY RESONATING BUBBLE FOR BIOMEDICAL IMPLANTATION**
 Wenbo Li, Anthony Mercader, and Sung Kwon Cho
University of Pittsburgh, USA

- MP-27 ON THE GEOMETRY DESIGN OF ALN LAMB WAVE RESONATORS WITH PREDEFINED SHALLOW RELEASE CAVITIES**
Tzu-Hsuan Hsu¹, Guan-Lin Wu¹, Yan-Ming Huang¹, Yens Ho², Yung-Hsiang Chen², Yelehanka Pradeep³, Rakesh Chand³, and Ming-Huang Li¹
¹*National Tsing Hua University, TAIWAN*, ²*Vanguard International Semiconductor Corporation, TAIWAN*, and ³*Vanguard International Semiconductor Corporation Singapore PTE. Ltd., SINGAPORE*
- MP-28 REALIZING THE WORLD'S SMALLEST GRAVIMETRIC SELF-RESETTING PARTICULATE MATTER SENSOR USING MEMS**
Navpreet Singh¹, Mohannad Y. Elsayed², and Mourad N. El-Gamal¹
¹*McGill University, CANADA* and ²*MEMS Vision International Inc., CANADA*
- MP-29 RECONFIGURABLE ARCHITECTURE EXTENDING BANDWIDTH LIMITS OF MICRO-ACOUSTIC RF FILTERS**
Giuseppe Michetti and Matteo Rinaldi
Northeastern University, USA
- MP-30 TEMPERATURE-STABLE THIN-FILM LITHIUM TANTALITE-ON-SILICON RESONATORS**
Yasaman Majd, Hamideh Kermani, and Reza Abdolvand
University of Central Florida, USA
- MP-31 ULTRASONIC AIR-BORNE PROPULSION THROUGH SYNTHETIC JETS**
Hai Liu, Akash Roy, Yongkui Tang, Martin Barekataan, and Eun Sok Kim
University of Southern California, Los Angeles, USA
- MP-32 WIRELESS AND STAND-ALONE SUBMARINE PROPELLER BASED ON ACOUSTIC PROPULSION**
Jaehoon Lee and Eun Sok Kim
University of Southern California, Los Angeles, USA

Technology, Materials, Packaging, and CAD

- MP-33 A FULLY STERILE, COST-EFFECTIVE, RAPIDLY ASSEMBLED, 3D PRINTER FOR BIOPRINTING OF ELECTROGENIC CELL CONSTRUCTS TO DEFINE FUNCTIONAL LAYERS AND ENHANCE SENSITIVITY OF CELL-BASED BIOSENSORS**
Cacie Hart, Frank Sommerhage, and Swaminathan Rajaraman
University of Central Florida, USA

- MP-34 A ZINC MICRO/NANO CONDUCTIVE PASTE FOR PAPER-BASED FLEXIBLE BIOELECTRONICS**
Amin Zareei, Vidhya Selvamani, Sachin Kadian, and Rahim Rahimi
Purdue University, USA
- MP-35 CONTROLLABLE STATIC BREATH-FIGURE PROCESSES TO FORM ORDERED 3-D MICROSTRUCTURES ON POLYDIMETHYLSILOXANE WITHOUT LITHOGRAPHY AND MOLDING**
Junce Cheng and Tingyi "Leo" Liu
University of Massachusetts, USA
- MP-36 MRI COMPATIBLE MULTIFUNCTIONAL CARBON NANOFIBER NEURAL PROBE**
Ziqi Jia, Paritosh Rustogi, Jack W. Judy, and Yong-Kyu "YK" Yoon
University of Florida, USA
- MP-37 NON-HERMETIC PACKAGING FOR FLEXIBLE MEDICAL IMPLANTS BASED ON MULTI-STACK PARYLENE C/PDMS BILAYER THIN FILMS**
Hao Chong^{1,2}, Steve J.A. Majerus², Kath M. Bogie^{1,2}, and Christian A. Zorman^{1,2}
¹Case Western Reserve University, USA and ²Louis Stokes Cleveland Veterans Affairs Medical Center, USA
- MP-38 PDMS MICROSTRUCTURES 3D-NANOPRINTED INSIDE UNCOATED, ENCLOSED PDMS-ON-GLASS MICROCHANNELS VIA IN SITU DIRECT LASER WRITING**
Xin Xu, Olivia M. Young, Adira Colton, and Ryan D. Sochol
University of Maryland, College Park, USA
- MP-39 ROOM TEMPERATURE SEAL-RING AU-TO-AU BONDING HERMETICITY AND RELIABILITY TESTING**
Amrid Amnache¹, Paul Gond-Charton², and Luc G. Fréchette¹
¹Université de Sherbrooke, CANADA and ²Teledyne Dalsa Semiconductor, CANADA
- MP-40 STABLE, ELECTRON-BEAM SUBLIMATED, NANOSTRUCTURED SILICON DIOXIDE ON POLYCARBONATE AND STAINLESS-STEEL AS A BIOADHERENT DIELECTRIC TOWARDS NEURAL MICROPHYSIOLOGICAL SYSTEMS**
Charles M. Didier¹, David Fox¹, Aliyah Baksh¹, Kevin Pollard², Nisha Iyer³, Alexander Bosak², Yuen Yee Li Sip¹, Julia Freitas Orrico¹, Randolph Ashton³, Michael J. Moore², Lei Zhai¹, and Swaminathan Rajaraman¹
¹University of Central Florida, USA, ²Tulane University, USA, and ³University of Wisconsin, USA

- MP-41 ULTRA-RAPID MICROFABRICATION OF HOLLOW-WELL
MICRONEEDLES BY DIFFRACTION ULTRAVIOLET (UV)
LITHOGRAPHY**
Yuankai Li¹, Jun Ying Tan¹, Rebecca Campbell², Won Min Park¹,
Albert Kim², and Jungkwun “JK” Kim¹
¹Kansas State University, USA and ²Temple University, USA

Late News - Chemical or Biological Sensors, Actuators or Systems

- MP-42 A WEARABLE SYSTEM FOR ELECTROCHEMICAL SENSING OF
SEROTONIN IN CRAYFISH**
Jinjing Han, Justin M. Stine, Ashley A. Chapin, Tawen Ho,
Norma Pena-Flores, Jens Herberholz, and Reza Ghodssi
University of Maryland, USA
- MP-43 GAS-PERMEABLE POLYDIMETHYLSILOXANE-ON-SILICON
MEMBRANES FOR EXTRACORPOREAL MEMBRANE
OXYGENATION**
Benjamin Chui, David Blauvelt, Francisco Baltazar,
Tariq Haniff, Jarrett Moyer, Nicholas Higgins, Peter Oishi,
and Shuvo Roy
University of California, San Francisco, USA
- MP-44 IN-SITU SAMPLE PROCESSING AND ELECTROENZYMATIC
SENSING FOR RELIABLE DEHYDROGENASE-BASED
WEARABLE BIOMARKER MONITORING**
Xuanbing Cheng, Jialun Zhu, Shuyu Lin, Sarah Forman,
and Sam Emaminejad
University of California, Los Angeles, USA
- MP-45 MONITORING BIOCHEMICAL REACTIONS USING
MICROSPHERICAL GLASS SHELL WHISPERING GALLERY
MODE RESONATORS**
Vedant Sumaria¹, Rosemary Smith², and Srinivas Tadigadapa¹
¹Northeastern University, USA and ²University of Maine, USA

Late News - Physical Sensors, Actuators, or Systems

- MP-46 DESIGN AND EXPERIMENTAL VALIDATION OF A
PIEZOELECTRIC RESONANT MEMS PHASE COMPARATOR**
Mathieu Gratuze and Frédéric Nabki
École de Technologie Supérieure, CANADA

- MP-47 SIMULTANEOUS MOISTURE AND SALINITY MONITORING IN SOILS USING SPLIT RING RESONATOR (SRR) BASED SCANNING FREQUENCY TRANSMITTORY (SFT)**
Sunghyun Hwang¹, William N. Carr², and Yong-Kyu Yoon¹
¹University of Florida, USA and ²NeptuneSensor, USA

Late News - Technology, Materials, Packaging, and CAD

- MP-48 3-D PRINTED REDOX-ACTIVE ORGANIC ELECTRODES TO BRIDGE ACROSS BIOLOGY AND ELECTRONICS**
Anwar Elhadad and Seokheun Choi
State University of New York, Binghamton, USA
- MP-49 ADDITIVE BATCH MICROFABRICATION OF 3D METAL ELECTROSTATIC SWITCHES TOWARDS 3D PRINTED METAL MEMS**
Bhushan Lohani¹, Sheikh D. Hossain¹, Thomas Starke², and Robert C. Roberts¹
¹University of Texas, El Paso, USA and ²3D Microprint GmbH, GERMANY
- MP-50 REGION-TARGETED BILAYER COATING TECHNOLOGY FOR INGESTIBLE DEVICES AND SYSTEMS**
Michael A. Straker, Joshua A. Levy, Justin M. Stine, Vivian Borbash, Luke A. Beardslee, and Reza Ghodssi
University of Maryland, USA



Poster Presentations - Session 2

Contributed and Late News

Wednesday, June 8

2:30 pm – 5:00 pm

Chemical or Biological Sensors, Actuators or Systems

- WP-01 A SWEAT-BASED SELF-CHARGING POWER SYSTEM: INTEGRATION OF MICROBIAL ENERGY HARVESTING AND STORING DEVICES**
Yang Gao and Seokheun Choi
State University of New York, Binghamton, USA
- WP-02 CHARACTERIZATION OF APTAMER FUNCTIONALIZED GOLD ELECTRODES FOR HISTONE DETECTION**
Hayley Richardson¹, Jeffrey Barahona¹, Gavin Carter¹, Francis J. Miller Jr.^{2,3,4}, Edgar Lobaton¹, and Spyridon Pavlidis¹
¹*North Carolina State University, USA*, ²*Duke University, USA*, ³*Wake Forest University, USA*, and ⁴*Salisbury Veterans Affairs Medical Center, USA*
- WP-03 DIRECT LASER WRITING OF TRIANGULAR-WALLED MICROARRAYS ONTO GLASS DIFFUSERS TO ENABLE CONTROLLED REFLECTIVITY UNDER ADAPTIVE OPTICS OPHTHALMIC IMAGING SYSTEMS**
Ian Rosenthal^{1,2}, Lucas Garcia-O'Donnell¹, Brian Ngho¹, Zhuolin Liu², Daniel X. Hammer², Anant Agrawal², and Ryan D. Sochol¹
¹*University of Maryland, College Park, USA* and ²*U.S. Food and Drug Administration, USA*
- WP-04 EXPLORING MICROSPHERICAL GLASS SHELL RESONATORS FOR VOLATILE ORGANIC COMPOUNDS SENSING**
Jiayuan Zhang, Vedant Sumaria, and Srinivas Tadigadapa
Northeastern University, USA
- WP-05 FLUID FORCES MODULATE CYTOKINE STIMULI FOR PERIPHERAL BLOOD MONONUCLEAR CELL ADHESION TO ENDOTHELIAL CELLS**
Prashanth Sundaram, Manjusha Kulkarni, Emily Bowman, Janelle Gabrielle, Nicholas Funderburg, and Shaurya Prakash
Ohio State University, USA

- WP-06** **IN VITRO TRI-CULTURE BLOOD-BRAIN BARRIER (BBB) MODEL ENABLING DIRECT INTERCELLULAR CONTACT AT A SUSPENDED LAYER**
Seungbeom Noh, Kenneth L. Monson, Vladimir Hlady,
and Hanseup Kim
University of Utah, USA
- WP-07** **IN-SOIL BIODEGRADABLE ZN-AIR BATTERIES**
Jingwen Zhang and Mark G. Allen
University of Pennsylvania, USA
- WP-08** **PAPER BASED MICROFLUIDICS INTEGRATED ELECTROCHEMICAL SENSOR FOR RAPID AND LOW-COST DETECTION OF ANALGESICS**
Akshay Krishnakumar, Rupesh Kumar Mishra, Amin Zaeeri,
Ulisses Alberto Heredia Rivera, and Rahim Rahimi
Purdue University, USA
- WP-10** **SELF-POWERED SWEAT ION SENSOR WITH LONG DURATION ELECTROCHEMICAL POTENTIAL**
Jorge A. Rodríguez and Daniela Diaz-Alonso
Center for Engineering and Industrial Development, MEXICO
- WP-11** **A WIRELESS PAPER-BASED SMART SENSOR FOR MEAT FRESHNESS MONITORING**
Sarath Gopalakrishnan, Sina Nejati, and Rahim Rahimi
Purdue University, USA
- WP-12** **STRETCHABLE GLUCOSE SENSOR VIA CONJUGATED POLYMER CONFORMALLY-COATED CNT ELECTRODES PARTIALLY EMBEDDED IN PDMS**
Anthony Palumbo¹, Chenguang Zhao¹, Hongjun Wang¹,
Kalle Levon², and Eui-Hyeok Yang²
¹*Stevens Institute of Technology, USA and*
²*New York University, USA*
- WP-13** **TOWARDS SINGLE-CELL PROTEOFORM PROFILING: ON-CHIP ISOELECTRIC FOCUSING IN IMMOBILIZED pH GRADIENT GELS**
Gabriela Lomeli¹ and Amy E. Herr^{1,2}
¹*University of California, Berkeley, USA and*
²*Chan Zuckerberg Biohub, USA*

Physical Sensors, Actuators, or Systems

- WP-14 3D MICROPRINTING OF MULTI-ACTUATOR SOFT ROBOTS ONTO 3D-PRINTED MICROFLUIDIC DEVICES VIA EX SITU DIRECT LASER WRITING**
Oliva M. Young¹, Chen-Yu Chen¹, Xin Xu¹, William E. Bentley¹, Mark D. Fuge¹, Axel Krieger², Paige Mass³, Joshua P. Kanter³, Laura Olivieri³, and Ryan D. Sochol¹
¹*University of Maryland, College Park, USA,*
²*Johns Hopkins University, USA, and*
³*Children's National Hospital & George Washington University, USA*
- WP-15 A 9.4 GHZ INTRINSICALLY SWITCHABLE LAMB-WAVE RESONATOR USING ATOMIC-LAYER-DEPOSITED FERROELECTRIC HAFNIA-ZIRCONIA**
Troy Tharpe and Roozbeh Tabrizian
University of Florida, USA
- WP-16 A MICROTIP EQUIPPED BIDIRECTIONAL MICROROBOT FOR NAVIGATING ON AND PENETRATING A LEAF SURFACE**
Tony H. Wang, Dea Gyu Kim, Zhijian Hao, and Azadeh Ansari
Georgia Institute of Technology, USA
- WP-17 A SEMI-ANALYTICAL MODELING OF COUPLED PIEZOELECTRIC RESONATORS BASED ON SUPPORT TRANSDUCER TOPOLOGY**
Chin-Yu Chang¹, Gayathri Pillai², and Sheng-Shian Li¹
¹*National Tsing Hua University, TAIWAN and*
²*Indian Institute of Science, INDIA*
- WP-18 AN OUT-OF-PLANE WIDE BANDWIDTH MICRO-G FM ACCELEROMETER WITH DIFFERENTIAL OUTPUT**
Seungyong Shin¹, Tanya Chauhan¹, Justin Matthews¹, Haoran Wen², and Farrokh Ayazi^{1,2}
¹*Georgia Institute of Technology, USA and*
²*StethX Microsystems, USA*
- WP-19 DEVELOPMENT OF A SCALABLE SOFT FINGER GRIPPER FOR SOFT ROBOTS**
Armin Jamali, Robert Knoerlein, Frank Goldschmidtboeing, and Peter Woias
University of Freiburg, GERMANY

- WP-20 ENHANCEMENT OF Q AND K² IN AL_{0.8}SC_{0.2}N/GAN/SAPPHIRE SURFACE ACOUSTIC WAVE RESONATORS USING SEMICONDUCTOR GROUND CONTACT**
Yue Zheng¹, Jialin Wang¹, Mingyo Park¹, Ping Wang², Ding Wang², Zetian Mi², and Azadeh Ansari¹
¹*Georgia Institute of Technology, USA and*
²*University of Michigan, USA*
- WP-21 GENERATION AND CONTROL OF INTERNAL FLOWS IN A SESSILE DROPLET BY SUBSTRATE OSCILLATION**
Tianyi Zhang, Peng Zhou, Terrence Simon, and Tianhong Cui
University of Minnesota, USA
- WP-22 IN-SITU ULTRASONIC IMAGING OF PRINTED ELECTRONICS INK DEPOSITION AND CURING**
Anuj Baskota¹, Landon Ivy², Carlos Ospina³, Justin Kuo¹, Juneho Hwang², Ved Gund², Benyamin Davaji^{2,4}, Peter Doerschuk², and Amit Lal^{1,2}
¹*Geegah Inc, USA,* ²*Cornell University, USA,* ³*BotFactory Inc., USA, and* ⁴*Northeastern University, USA*
- WP-23 LITHIUM NIOBATE ON SILICON LAMB MODE ACOUSTOELECTRIC WAVEGUIDE WITH 5.5 DB SUSTAINED TERMINAL GAIN**
Hakhamanesh Mansoorzare and Reza Abdolvand
University of Central Florida, USA
- WP-24 WIRELESS PH SENSOR FOR SPOILAGE DETECTION MANUFACTURED IN ONE-STEP LASER-ETCHING PROCESS**
Jose Waimin, Sarath Gopalakrishnan, and Rahim Rahimi
Purdue University, USA
- WP-25 MEMS RESONATOR MATCHING NETWORK FOR HIGH-SENSITIVITY SCALN PMUT-BASED ULTRASOUND RECEIVERS**
Bernard Herrera Soukup, Pietro Simeoni, Gabriel Giribaldi, Luca Colombo, and Matteo Rinaldi
Northeastern University, USA
- WP-26 MODE LOCALIZATION AND TUNABLE OVERLAP IN A CLOSED-CHAIN MICROMECHANICAL RESONATOR ARRAY**
Joon Hyong Cho^{1,2}, Michael A. Cullinan², and Jason J. Gorman¹
¹*National Institute of Standards and Technology (NIST), USA and*
²*University of Texas, Austin, USA*

- WP-27 PHYSICALLY FLEXIBLE MULTI-LAYER LIQUID METAL-BASED BAND-PASS METASURFACE**
Arkadeep Mitra¹, Kevin Xu², Jun H. Choi², and Jeong-Bong Lee¹
¹University of Texas, Dallas, USA and ²University at Buffalo, USA
- WP-28 PIEZORESISTIVE MICRO-PILLAR SENSOR FOR IN-PLANE FORCE SENSING FOR BIOLOGICAL APPLICATIONS**
Isha Lodhi¹, Durga Gajula¹, Devin K. Brown¹, Wilbur A. Lam^{1,2,3}, David R. Myers^{1,2,3}, and Oliver Brand¹
¹Georgia Institute of Technology, USA, ²Emory University, USA, and ³Children's Healthcare of Atlanta, USA
- WP-30 ULTRA-LOW NOISE, HIGH-SENSITIVITY MEMS ACCELEROMETER FOR SATELLITE GRAVIMETRY**
Inês S. Garcia^{1,2}, Abdelrahman M. Elhawash¹, Jorge Cabral², Tiago Hormigo³, João T. da Encarnação^{4,5}, Filipe S. Alves^{1,2}, and Rosana A. Dias¹
¹International Iberian Nanotechnology Laboratory (INL), PORTUGAL, ²University of Minho, PORTUGAL, ³Spin.Works S.A., PORTUGAL, ⁴Delft University of Technology, NETHERLANDS, and ⁵University of Texas, Austin, USA
- WP-31 WAFER-LEVEL HIGH-ASPECT-RATIO DEEP REACTIVE ION ETCHING OF 4H-SILICON CARBIDE ON INSULATOR SUBSTRATES**
Ardalan Lotfi¹, Micheal P. Hardin¹, Zhenming Liu¹, Alex Wood², Chris Bolton², Kevin Riddell², Huma Ashraf², Joanne Carpenter², and Farrokh Ayazi¹
¹Georgia Institute of Technology, USA and ²SPTS Technologies – A KLA Company, UK
- WP-32 ZERO-POWER MULTI-THRESHOLD TEMPERATURE SENSOR BASED ON SHAPE MEMORY ALLOY ANTENNA**
Wenxin Zeng, Wei Wang, and Sameer Sonkusale
Tufts University, USA

Technology, Materials, Packaging, and CAD

- WP-33 A MODULAR MICROFABRICATION APPROACH WITH MULTI-LAYER MICROPILLAR 3D INTERCONNECTS, UTILIZING DLP 3D PRINTING TOWARDS 3D MICROELECTRODE ARRAYS AND COMPLEX MICROSYSTEMS**
Charles M. Didier, Avra Kundu, and Swaminathan Rajaraman
University of Central Florida, USA

- WP-34** **CONSTANT PHASE ELEMENT (CPE) MODELING AND ANALYSIS OF MULTI-MATERIAL, MICRO-BULLET SHAPED, HIGH-THROUGHPUT 3D MICROELECTRODES FOR *IN-VITRO* ELECTROPHYSIOLOGICAL APPLICATIONS**
 Jorge Manrique Castro and Swaminathan Rajaraman
University of Central Florida, USA
- WP-35** **MECHANICAL SENSING TOWARDS 3D-PRINTED WEARABLES**
 Sonia F. Roberts¹, Jack Forman², Hiroshi Ishii², and Kristen L. Dorsey^{1,2}
¹*Northeastern University, USA and*
²*Massachusetts Institute of Technology, USA*
- WP-36** **MULTIFUNCTIONAL 3D PRINTED BATIO₃ PLATONIC SOLIDS PACKAGING FOR IMPLANTABLE MICRODEVICES**
 Sayemul Islam¹, Sumnoon Ahmed¹, Alanis I. Santiago¹, Michael Domic¹, Jungkwun Kim², Seung H. Song³, and Albert Kim¹
¹*Temple University, USA,* ²*Kansas State University, USA, and*
³*Sookmyung Women's University, KOREA*
- WP-37** **PAPERTRONICS: FULLY PAPER-INTEGRATED RESISTOR, CAPACITOR, AND TRANSISTOR CIRCUITS**
 Mya Landers, Anwar Elhadad, and Seokheun Choi
State University of New York, Binghamton, USA
- WP-38** **PIEZOELECTRIC PAPER: LARGE-SCALE COMPATIBLE MANUFACTURING PROCESS AND SENSOR DEMONSTRATION**
 Kanagasubbulakshmi Sankaralingam, Ninweh Nina George, Sajana Sumanasinghe, Anindya L. Roy, Konrad Walus, and Boris Stoeber
University of British Columbia, CANADA
- WP-39** **SCALABLE AND VERSATILE FABRICATION OF OPAL STRUCTURES WITH SLOPE SELF-ASSEMBLY AND CAPILLARY PEELING FOR MICRODEVICES AND SENSORS**
 Carlos D. Díaz-Marín¹, Diane Li¹, Samantha Cheung¹, Cameron Kilpatrick², Rishabh Shetty¹, Geoffrey Vaartstra¹, Ashwin Gopinath¹, and Evelyn N. Wang¹
¹*Massachusetts Institute of Technology, USA and*
²*Stanford University, USA*
- WP-40** **ULTRA FLEXIBLE MACROPOROUS MICRONEEDLES FOR SUSTAINED DELIVERY OF (2R,6R)-HYDROXYNORKETAMINE**
 Riddha Das¹, Aydin Sadeqi¹, Caroline A. Browne², Irwin Lucki², and Sameer Sonkusale¹
¹*Tufts University, USA and*
²*Uniformed Services University of Health Sciences, USA*

Late News - Chemical or Biological Sensors, Actuators or Systems

- WP-41 A MOLECULAR IMPRINTED POLYMER (MIP)-BASED NT-PROBNP SENSING ELECTRODE USING LG9 PEPTIDES FOR HEART FAILURE MONITORING**
Liang-Kai Wan¹, Chih-Hung Lin¹, Yu-Ting Cheng¹, Hsiao-En Tsai², and Chih-Kuo Lee²
¹National Yang Ming Chiao Tung University, TAIWAN and
²National Taiwan University Hospital Hsin-Chu Branch, TAIWAN
- WP-42 HEAVY METAL SENSING IN VEGETABLE AND SOIL SOLUTIONS USING CARBON FIBER ELECTRODE**
G M Hasan Ul Banna¹, James Siegenthaler², Romilly Benedict¹, Wei Zhang¹, and Wen Li^{1,2}
¹Michigan State University, USA and
²Fraunhofer USA Center Midwest, USA
- WP-43 RAPID COST-EFFECTIVE PLOTTER CUT STENCIL MASKS FOR THE DEPOSITION OF ORGANIC AND INORGANIC MATERIALS AND THE CREATION OF A NEW ANTIBIOTIC DIFFUSION TEST FOR MINIMAL LETHAL CONCENTRATION DETECTION**
Andre Childs, Jorge Pereira, Aliyah Baksh, Charles M. Didier, Edwin Davidson, Swadeshmukul Santra, and Swaminathan Rajaraman
University of Central Florida, USA
- WP-44 SCALING EFFECTS OF INKJET MICROFABRICATED 3D GOLD ELECTROCHEMICAL SENSORS FOR AQUEOUS LEAD DETECTION**
Annatoma Arif, Bertha J. Chavez, Sheikh D. Hossain, and Robert C. Roberts
University of Texas, El Paso, USA
- WP-45 SMART ELECTROPALATOGRAPHY THIN-FILM FLXIBLE PRESSURE SENSOR ARRAY FOR LINGUISTIC AND MEDICAL APPLICATIONS**
Saeyeong Jeon, Ziqi Jia, Sunghyun Hwang, Suk-il Choi, Jiho Han, and Yong-Kyu Yoon
University of Florida, USA

WP-46 THEORETICAL AND EXPERIMENTAL VALIDATION ON THE TUNING CAPABILITY OF A PERCOLATION-BASED GAS SENSOR

Farhan Sadik Sium, Shakir ul Khan, Seungbeom Noh,
and Hanseup Kim
University of Utah, USA

Late News - Physical Sensors, Actuators, or Systems

WP-47 A 17.3 GHZ ATOMIC-LAYERED HZO SOLIDLY MOUNTED RESONATOR: TOWARDS CMOS-BEOL MM-WAVE FREQUENCY CONTROL

Troy Tharpe, Shaurya Dabas, Dicheng Mo, and Roozbeh Tabrizian
University of Florida, USA

WP-48 CO-RESONANT CANTILEVERS FOR MATERIALS RESEARCH AND SENSOR APPLICATIONS

Julia Körner
Leibniz University Hannover, GERMANY

WP-49 FOCUSING OF A RELATIVISTIC ELECTRON BEAM WITH A MICROFABRICATED QUADRUPOLE MAGNET

Benjamin A Pound, Sophie Crisp, Alexander Ody, Pietro Musumeci,
James Rosenzweig, and Robert Candler
University of California, Los Angeles, USA

WP-50 INCREASING ELECTORRHEOLOGICAL RESPONSE IN HYDRAULIC ACTUATORS VIA SCALABLE MICROPATTERNED ELECTRODES

Chastity M. Kelly¹, Ashkan Ghanavati¹, Peter G. Kelly²,
and Carol Livermore¹

¹*Northeastern University, USA* and ²*Markforged, Inc, USA*



Poster Presentations - Session 3

Invited Open Posters, Commercial Posters, and Open Posters

Wednesday, June 8

6:30 pm – 8:00 pm

Invited Open Posters

- WIOP-51 AUTOMOTIVE MEMS ACCELEROMETER DESIGN VERIFICATION USING NONLINEAR COMPACT MODELING**
Shaikh Md Rubaiyat Tousif¹, Brian Van Dyk², and Aaron Geisberger¹
¹*NXP Semiconductors Inc., USA and*
²*Coventor, Inc., A Lam Research Company, USA*
- WIOP-52 EXPLORE MEMS SWITCH FOR HIGH POWER AC/DC APPLICATIONS**
Xu Zhu, Jim Terazawa, Chris Nassar, Michael Comstock, and Chris F. Keimel
Menlo Microsystems, Inc, USA
- WIOP-53 HYDROGEN GETTERS FOR MICROELECTRONICS PACKAGING RELIABILITY IMPROVEMENT**
Hua Xia, Jeffery Vriens, and David DeWire
Hermetic Solutions Group, LLC, USA
- WIOP-54 LOW-POWER MULTI-ELEMENT GAS SENSOR MANUFACTURED BY MICROCHANNEL PARTICLE DEPOSITION**
Serhii Mytnyk, Victoria Shalabaeva, Thomas Russell, and Marnix Rebergen
Mesoline, NETHERLANDS

Commercial Posters

- WCP-55 ENRICHING LIVES WITH PERFORMANCE SENSING**
Stephen F. Bart¹, Nishit Goel², Leonardo Baldassarre³, Ilya Gurin¹, and Peter Hartwell¹
¹*TDK - Invensense, USA,* ²*TDK - Invensense, ITALY, and*
³*TDK - Invensense, INDIA*
- WCP-56 CUSTOMIZED MEMS SOLUTIONS FROM PROTOTYPE TO PRODUCTION VOLUMES**
James Walker¹, Arne Leinse², and Douwe Geuzebroek²
¹*LioniX International, USA and*
²*LioniX International, NETHERLANDS*

- WCP-57 EXPANDING THE WORLD OF MEMS THROUGH FLAT PANEL
FABS**
Kimberly L. Harrison and Alissa M. Fitzgerald
A.M. Fitzgerald & Associates, LLC, USA
- WCP-58 FULL OPTICAL CHARACTERIZATION OF MEMS REAL-TIME
DYNAMICS AND 3D TOPOGRAPHY**
David F. Oliver¹, Eric Lawrence¹, Marcus Winter², Markus Heilig²,
and Heinrich Steger²
¹Polytec, Inc., USA and ²Polytech GmbH, GERMANY
- WCP-59 FULL-FIELD VIBRATION MODE SHAPE AND TRANSIENT
ANALYSIS BY 4D DIGITAL HOLOGRAPHIC MICROSCOPE
(DHM®)**
Shenqi Xie, Frank Liu, and Yves Emery
Lyncée Tec, SWITZERLAND
- WCP-60 IMPROVING YOUR UNDERSTANDING OF ADVANCED MEMS
DESIGN PROBLEMS: FASTER DESIGN AND SIMULATION FOR
BETTER RELIABILITY, MANUFACTURING AND PERFORMANCE**
Christopher Welham¹, Arnaud Parent¹, Brian Van Dyk², and
Hideyuki Maekoba³
*¹Coventor, A Lam Research Company, FRANCE,
²Coventor, A Lam Research Company, USA, and
³Coventor, A Lam Research Company, JAPAN*
- WCP-61 LOWERING BARRIERS TO MICROSYSTEMS INNOVATION**
Andrew Fung, Qader Qureshi, and Gord Harling
CMC Microsystems, CANADA
- WCP-62 MASKLESS LITHOGRAPHY**
Rick Trevino
Heidelberg Instruments Inc., USA
- WCP-63 NATIONAL NANOTECHNOLOGY COORDINATED
INFRASTRUCTURE (NNCI)**
Oliver Brand, David S. Gottfried, and Paul J. Joseph
Georgia Institute of Technology, USA
- WCP-64 PDKS (PROCESS DESIGN KITS) FOR PIEZO-ELECTRIC MEMS
FABRICATION PROCESSES INCLUDING MANUFACTURING
VARIATIONS IN DEVICE DESIGNS**
Mary Ann Maher
SoftMEMS LLC, USA

- WCP-65 REDUCED ORDER MODELING FOR MEMS**
 Philipp Jan Mehner, David Kriebel, and Jan Edgar Mehner
I-ROM GmbH, GERMANY
- WCP-66 SILICON MATTERS - IMPORTANCE OF SILICON SPECS WHEN GROWING THERMAL OXIDE**
 Cat Nyland and Kat Anaya
Rogue Valley Microdevices, USA
- WCP-67 VARIOUS PZT THIN FILMS FOR MEMS ACTUATORS, SENSORS, AND TRANSDUCERS**
 Hiroshi Miyajima¹, Mario Kiuchi¹, Yukitaka Yamaguchi¹, Takashi Ikeda², and Gen Matsuoka¹
¹*Sumitomo Precision Products, Co., Ltd., JAPAN and*
²*Silicon Sensing Products, Ltd., JAPAN*
- WCP-68 ELECTROPHYSIOLOGY ENABLED BIOSENSORS**
 Frank Sommerhage¹, David W. DeRoo¹, and Swami Rajaraman²
¹*Primordia Biosystems, USA and* ²*University of Central Florida, USA*
- WCP-69 THERE'S NOT MUCH ROOM LEFT AT THE BOTTOM - NANOPOWER MOTION SENSING USING THE ADXL367**
 Tzeno Galchev
Analog Devices, Inc., USA

Open Posters

- WOP-01 ADAPTIVE BISTABLE CIRCUITRY NETWORK FOR BIFURCATION-BASED MICROSCALE MASS MEASUREMENT**
 Jinki Kim
Georgia Southern University, USA
- WOP-02 ADVANCED MANUFACTURING LABORATORY AT THE UNIVERSITY OF MARYLAND**
 Kevin Daniels, Justin Stine, Jimjing Han, Daniel Lewis, and Reza Ghodssi
University of Maryland, USA
- WOP-03 CAPSULE-BASED BIOIMPEDANCE SENSING FOR INFLAMMATORY BIOMARKER DETECTION IN GASTROINTESTINAL TRACT**
 Hossein Abianeh¹, Vivian Borbash¹, Brian Holt¹, Joshua Levy¹, Michael Straker¹, Justin Stine¹, Luke Beardslee¹, and Jay Parischa²
¹*University of Maryland, USA and* ²*Johns Hopkins University, USA*

- WOP-04 CLASSIFICATION OF NUCLEUS SIZE USING A MICROFLUIDIC BROADBAND SENSOR AND MULTIPLE MACHINE LEARNING PARADIGMS**
 Caroline Ferguson, Yu Zhang, and Xuanhong Cheng
Lehigh University, USA
- WOP-05 DATA DRIVEN QUALITY ASSURANCE QUALITY CONTROL (QA/QC) MEASURES FOR MINIATURE CHIP-BASED PRECONCENTRATORS SCALED FOR PRODUCTION**
 Bradley Chew¹, Nhi Trinh¹, Dylan Koch², Maneeshin Rajapakse¹, Leslie Simms¹, Mitchell McCartney¹, Nicholas Kenyon¹, and Cristina Davis¹
¹*University of California, Davis, USA and*
²*VA Northern California Health Care System, USA*
- WOP-06 HYBRID PHONONIC-PHOTONIC CRYSTAL RESONATORS FOR OPTOMECHANICS**
 Yiliang Bao, Feng Zhou, John Lawall, and Jason Gorman
National Institute of Standards and Technology, USA
- WOP-07 LAB-ON-CMOS CAPACITANCE SENSOR FOR TRACKING SINGLE CELL BEHAVIOR AND VIABILITY**
 Pamela Abshire
University of Maryland, USA
- WOP-08 LARGE SIGNAL ANALYSIS AND MODELING OF CMOS-MEMS FERROELECTRIC RESONATORS**
 Udit Rawat, Jackson Anderson, and Dana Weinstein
Purdue University, USA
- WOP-09 MAGNETIC-FREE NITRIDE OPTICAL ISOLATOR ON CHIP**
 Hao Tian¹, Junqiu Liu², Anat Siddharth², Rui Wang², Terence Blesin², Jijun He², Tobias Kippenberg², and Sunil Bhawe¹
¹*Purdue University, USA and* ²*École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND*
- WOP-10 MEMBRANE AND PLATE MECHANICAL MODEL EFFECTS ON LINEARITY IN MEMS MICROPHONES**
 David Cayll^{1,2}, Lorraine Wilson², and Michael Cullinan¹
¹*University of Texas, Austin, USA and* ²*GraphAudio Inc., USA*
- WOP-11 MICROFLUIDIC PLATFORM FOR DNA SEQUENCE PROFILING TOWARDS EARLY DETECTION OF CANCER**
 Christine O'Keefe, Yang Zhao, Thomas Pisanic, Tian-Li Wang, le Ming Shih, and Tza-Huei Wang
Johns Hopkins University, USA

WOP-12 OPPORTUNITIES FOR THE MICROSYSTEMS COMMUNITY TO ADDRESS GRAND CHALLENGES

Jack Judy

University of Florida, USA

WOP-13 SELF-ALIGNED SINGLE-ELECTRODE ACTUATION OF TANGENTIAL & WINEGLASS MODES

Ozan Erturk¹, Kilian Shambaugh², Jeong-Ho Lee³, Sang-Goo Lee³, and Sunil Bhawe¹

¹Purdue University, USA, ²Polytec Inc., USA, and

³iBule Photonics, KOREA

WOP-14 THERMOFORMING OF PARYLENE C FOR 3D STRUCTURES

Brianna Thielen and Ellis Meng

University of Southern California, USA

WOP-15 TUNABLE MICROMACHINED RESONATORS BASED ON YTTRIUM IRON GARNET

Sen Dai¹, Yiyang Feng¹, Sudhanshu Tiwari¹, Sunil Bhawe¹, and Renyuan Wang²

¹Purdue University, USA and ²BAE Systems, USA

WOP-16 WEARABLE AND STRETCHABLE PIEZOELECTRIC POWER GENERATOR BASED ON THIN FILM OF ZNO

Shuo Fang¹, Fang Li², and Ioana Voiculescu¹

¹City College of New York, USA and

²New York Institute of Technology, USA





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