

FINAL PROGRAM



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connecting big ideas and small tech

PROGRAM-AT-A-GLANCE

Monday, 3 June

07:00	Breakfast
07:45 - 08:15	Welcome
08:15 - 08:55	Plenary Speaker I - Cherie R. Kagan, Ph.D. University of Pennsylvania, USA
08:55 - 10:15	Session 1 - Microsystems for Biosensing
10:15 - 10:44	Break and Tabletop Inspection
10:44 - 10:45	Wen Ko Technical Leadership Award Announcement
10:45 - 11:15	Invited Speaker I Alissa M. Fitzgerald, Ph.D., AMFitzgerald, USA
11:15 - 12:15	Session 2 - Industrial, Higher TRL Microsystems
12:15 - 12:20	Oliver Brand Remembrance
12:20 - 12:45	Poster Preview - Session 1
12:45 - 14:15	Networking Lunch
14:15 - 16:45	Poster Session 1 - Contributed and Late News

Tuesday, 4 June

07:30	Breakfast		
08:00	Announcements		
08:05 - 08:45	Plenary Speaker II - Tobias Kippenberg, Ph.D. EPFL, SWITZERLAND		
08:45 - 09:45	Session 3 - Resonators, Oscillators and Micromotors		
9:45 - 10:14	Break and Tabletop Inspection		
10:14 - 10:15	Denice Denton Mentorship Award Announcement		
10:15 - 10:45	Invited Speaker II Michael Fonseca, Ph.D., StethX, USA		
10:45 - 11:45	Session 4 - Chemical and Environmental Sensing		
11:45 - 12:15	Hilton Head Education, History, and Conservation Talk Jan McKelvey, Lean Ensemble Theater, USA		
12:15 - 13:30	Networking Lunch		
14:00 - 19:00	MSIG Industry Session 14:00 - 16:00	Beyond Technical Expertise 14:00 - 16:00	Recreational & Student Activities 14:00 - 19:00
19:00 - 22:00	Banquet		

Wednesday, 5 June

07:15	Women in MEMS Breakfast
07:30	Breakfast
08:10	Announcements
08:15 - 08:55	Plenary Speaker III - Christopher J. Cannova M.D. Aligned Orthopedic Partners, USA
08:55 - 10:15	Session 5 - Medical MEMS
10:15 - 10:44	Break and Tabletop Inspection
10:44 - 10:45	Mark Shannon Grand Challenges Award Announcement
10:45 - 11:15	Invited Speaker III Joshua Windmiller, Ph.D., Dexcom, USA
11:15 - 12:15	Session 6 - Novel Devices
12:15 - 13:00	Poster Preview - Session 2 Commercial Posters
13:00 - 14:30	Networking Lunch
14:30 - 17:00	Poster Session 2 - Contributed and Late News
17:00 - 18:30	Free Time
18:30 - 19:30	Poster Session 3 and Reception Commercial & Open Posters
20:00 - 22:00	Rump Session

Thursday, 6 June

07:30	Breakfast
08:10	Announcements
08:15 - 08:55	Plenary Speaker IV - Evelyn N. Wang, Ph.D. ARPA-E, USA
08:55 - 09:55	Session 7: Novel Devices and Processes
09:55 - 10:25	Break and Tabletop Inspection
10:25 - 10:55	Invited Speaker IV Ginel Hill, SiTime, USA
10:55 - 11:55	Session 8 - Late News
11:55 - 12:30	Award Ceremony and Closing Remarks
12:30 - 14:00	Networking Lunch
14:00	Workshop Adjourns

TABLE OF CONTENTS

General Information	4
Guest Packages	6
Social Events	6
Student Events	7
Organizing Committee	8
Transducer Research Foundation (TRF)	10
Commercial Support	12
Tabletop Exhibitors	19
Tabletop Floorplan	23
Awards	24

Technical Program

Special Events	30
Sunday Program	32
Monday Program	35
Tuesday Program	38
Wednesday Program	41
Thursday Program	44
Poster Presentations - Session 1	46
Poster Presentations - Session 2	54
Poster Presentations - Session 3	62
Conference Announcements	68



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

GENERAL INFORMATION

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 "**High Speed**"



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 are 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, 07:30 – 10:00), 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, 18:00 - 21:00 outside in the Pavilion.

Tuesday Banquet

The Banquet will be held on Tuesday evening, 19:00 - 22:00 outside in the Pavilion and is sponsored in part by:



Beach Volleyball

The Beach Volleyball tournament, sponsored by Analog Devices, will be held on Tuesday afternoon between 15:00 and 18:00. 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, please sign-up at the Workshop Registration Desk so we may get a headcount for refreshments.



Women in MEMS Breakfast

The Women in MEMS Breakfast will be on Wednesday from 07:15 - 08:10 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.

Student Networking Events

Lunches - During lunch each day, there will be reserved tables in the outdoor pavilion for students to network and socialize.

Sandcastle Building – Join us Tuesday at 14:00 on the beach and compete in Sandcastle Building. You will form teams of students from different universities and compete for prizes and glory!

Scavenger Hunt – Join us on the student Slack channel (<https://hiltonheadworkshop.slack.com/>) for a workshop scavenger hunt!



ORGANIZING COMMITTEE

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Program Chair Swaminathan Rajaraman, University of Central Florida, USA

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THE TRANSDUCER RESEARCH FOUNDATION (TRF) is a non-profit organization whose purpose is to stimulate research in science and engineering, and to foster a technical community that promotes the exchange of ideas and information and provides career development opportunities. With emphasis on technologies related to transducers, microsystems, and nanosystems, these objectives will be pursued through a variety of activities and initiatives, including but not limited to the following:

1. Sponsoring and organizing regional, national, and international conferences, meetings, workshops, and short courses in transducers, microsystems, and nanotechnology. Net proceeds raised during the sponsored events are retained and utilized by TRF to support future activities and initiatives.
2. Raising and administering the distribution of funds with the purpose of enhancing and encouraging advances in the fields of transducers, microsystems, and nanotechnology.
3. Fostering liaison between academic, industry, and government organizations to enhance cooperation and collaboration.
4. Providing mentoring and continuous education to students and young professionals in science, engineering, technology, and related fields.
5. Supporting research in the fields of microfabricated sensors, actuators, and mechanical components, as well as microsystems, nanosystems, and the underlying technologies that advance all of these fields, through scholarships, seed grants for new conferences and workshops, grants for student travel to conferences, and other means.

TRF welcomes inquiries from individuals and 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 the options for TRF sponsorship or student travel grants, please contact a TRF Officer/Director, or email 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.



The Transducer Research Foundation, Inc. would also like to thank the following companies for their support, encouragement, and involvement in the 2024 Solid State Sensors, Actuators, and Microsystems Workshop.

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Established in 2003, A.M. Fitzgerald & Associates, LLC ("AMFitzgerald") provides expert MEMS product development services and solutions, including: custom MEMS design, emerging technology development, simulation, process integration, MEMS prototype fabrication, package and test, foundry selection and transfer with support through production, and strategy consulting.

IEEE MEMS Technical Community

ieeememstc.org



IEEE Micro Electro Mechanical Systems (MEMS) Technical Community will keep you abreast of the latest in MEMS ideas, designs, and manufacturing methodologies, many of which could very well spark new thinking and enable new capabilities in a myriad of IEEE fields. MEMS is an enabling technology harnessing the benefits of miniaturization in physical domains beyond the electrical and found in billions of devices today.

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The ECE Department at UF has a long and storied history—since 1909, we have been engineering impact and innovation while creating the best workforce in electrical and computer engineering for the state of Florida and for the nation. Our research, discoveries, and the resulting technologies continue to touch lives everywhere.

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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 sensors, MEMS, and microtechnologies for the advancement of civilization and creation of market value.

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The Viterbi School of Engineering has at least four tenure track faculty members (in AME, BME and ECE departments) whose main research thrusts are in MEMS including but not limited to acoustic, biomedical, energy-harvesting, microfluidic and wearable MEMS.

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www.semi.org/en/communities/msig



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.

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EXHIBITORS

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IEEE Micro Electro Mechanical Systems (MEMS) Technical Community will keep you abreast of the latest in MEMS ideas, designs, and manufacturing methodologies, many of which could very well spark new thinking and enable new capabilities in a myriad of IEEE fields. MEMS is an enabling technology harnessing the benefits of miniaturization in physical domains beyond the electrical and found in billions of devices today.

Institute for NanoSystems Innovation (NanoSI)	10
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at Northeastern University
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LioniX International	8
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www.lionix-international.com

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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SoftMEMS LLC	2
2391 Nobili Avenue Santa Clara, CA 95051 USA phone: +1-510-847-4170 info@softmems.com www.softmems.com	

SoftMEMS sells powerful, easy to use computer aided design (CAD) tools for the co-design and modeling of products and systems including MEMS and sensors, packaging and electronics.

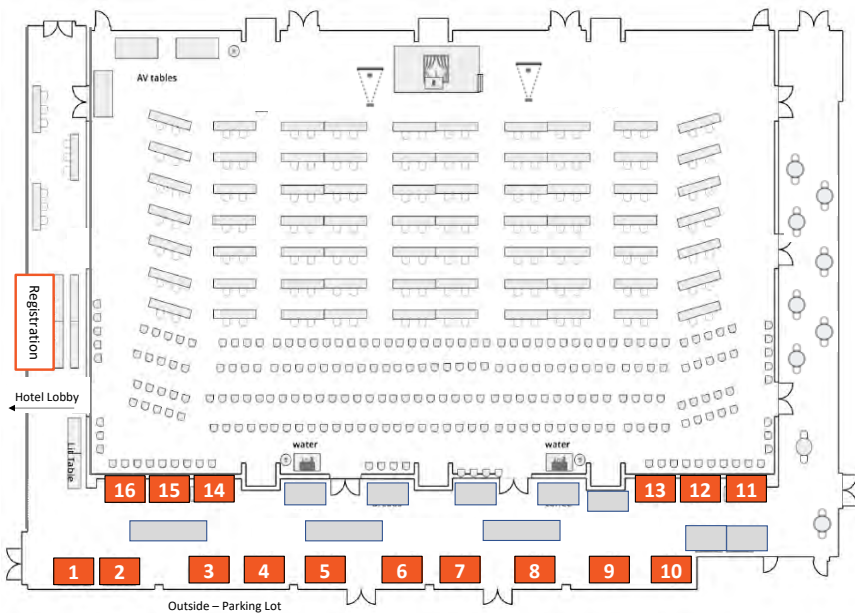
SUSS MicroTec Inc.	7
2520 Palisades Drive Corona, CA 92882 USA phone: +1-951-817-3700 info@suuss.com www.suuss.com	

SUSS MicroTec provides solutions for semiconductor microstructuring, works on 3D integration, nanoimprint lithography, MEMS and LED processes and supports over 8,000 systems worldwide.



Tabletop Floor Plan

Santee Ballroom Foyer



A.M. Fitzgerald & Associates, LLC	4
DEEPLIGHT	16
EV Group, Inc.	1
Heidelberg Instruments Inc.	9
IEEE MEMS Technical Community	14
Institute for NanoSystems Innovation (NanoSI)	10
InvenSense, a TDK Group Company	15
LioniX International	8
Lyncee Tec SA	6
memsstar Ltd	3
Polytec, Inc.	13
Science Corporation	5
SoftMEMS LLC	2
SUSS MicroTec Inc.	7

AWARDS

DENICE DENTON MENTORSHIP AWARD

The Hilton Head Workshop is pleased to announce the 2024 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."

MARK SHANNON GRAND CHALLENGES AWARD

The Hilton Head Workshop is pleased to announce the 2024 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.



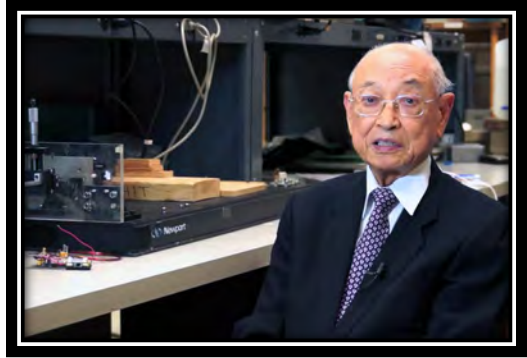
A pillar of our Hilton Head community, his international reputation and passion for his work was evident whether he was teaching students or testifying before Congress, and his energy and tenacity attracted others from around the world to share his vision and work to solve society's problems. By his 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."

WEN KO TECHNICAL LEADERSHIP AWARD

The Hilton Head Workshop is pleased to announce the 2024 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.

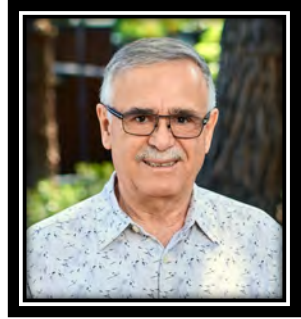
A light to generations of young engineers, he advised more than 150 MS and PhD students. He established and led the Electronics Design Center at CWRU and was a Fellow of IEEE Biomedical Engineering Society and the American Institute of Medical and Biological Engineering. He was one of the founders of 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."

JANUSZ BRYZEK ABUNDANCE THROUGH MEMS AWARD

The Janusz Bryzek Abundance through MEMS award seeks to recognize graduate or undergraduate students whose work best exemplifies the application of MEMS to Abundance. Abundance refers to a future in which all of humanity has access to clean water, food, energy, health care, housing, education and everything else to live an abundant fulfilling life due to rapid developments in exponential technologies including MEMS. Janusz Bryzek was a pioneering and prolific MEMS entrepreneur who started 11 companies and was committed to the vision of Abundance. This award, honoring Janusz' legacy, will recognize emerging researchers in MEMS and related fields whose work significantly contributes to the vision of Abundance.

Dr. Janusz Bryzek was a world-renowned pioneer in the field of micro-electromechanical systems (MEMS), founding and commercializing his MEMS passion vis-à-vis 11 companies over his 40 plus year career ... from pressure sensors to multiplexers, IMUs to ultrasonic imagers. An optimistic technology enthusiast, he envisioned the abundance of ubiquitous low-cost MEMS devices as a means of improving the quality of lives globally. As such, he operated at the convergence of MEMS, Entrepreneurism, and Abundance.



Abundant Nexus

MICROSYSTEMS & NANOENGINEERING/SPRINGER NATURE BEST PAPER AWARD BENEFACTOR

Microsystems & Nanoengineering/Springer Nature

No. 19, North Fourth Ring West Road, Haidian District

Beijing, 100190 CHINA

phone: +86-10-5888-7222

mine@aircas.ac.cn

www.nature.com/micronano

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MICROMACHINES - MDPI BEST POSTER AWARD BENEFACTOR

micromachines - MDPI

St. Alban-Anlage 66

Basel, 4052 SWITZERLAND

phone: +41-61-683-7734

micromachines@mdpi.com

www.mdpi.com/journal/micromachines

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STUDENT TRAVEL AWARDS

DEVCOM Army Research Laboratory

www.arl.army.mil/



The U.S. Army Combat Capabilities Development Command (DEVCOM) Army Research Laboratory is the Army's corporate research laboratory strategically placed under the Army Futures Command. ARL is the Army's sole fundamental research laboratory focused on cutting-edge scientific discovery, technological innovation, and transition of knowledge products that offer unprecedented potential to improve the Army's chances of surviving and winning any future conflicts.

National Institutes of Health (NIH)

www.nih.gov/



**National Institutes
of Health**

The National Institutes of Health (NIH), a part of the U.S. Department of Health and Human Services, is the nation's medical research agency — making important discoveries that improve health and save lives.



SPECIAL EVENTS

WORKSHOP 1: MEMS KNOW HOWE

Sunday - 10:00 - 15:00 - Savannah Jr. Ballroom

Professor Roger Howe, a leading figure in the field of Micro-Electro-Mechanical Systems (MEMS), is set to retire from Stanford University this year. In honor of his retirement, a symposium is being organized to celebrate his transformative contributions to MEMS technology.

The event will feature talks from Professor Howe's colleagues and students, who will highlight the various facets of his impact on the MEMS community. Specific focus areas will include surface micromachining, resonators, oscillators, inertial sensors, self-assembly processes, adhesion in microstructures, optical MEMS, biosensors, and other applications. The symposium aims to acknowledge Professor Howe's enduring influence on MEMS, offer insights into key advancements from both academia and industry, and inspire a new wave of pioneers in the field.

WORKSHOP 2: SMALL-SCALE ROBOTS: FROM ONE TO A SWARM

Sunday - 11:00 - 17:00 – Charleston Room, 2nd Floor

The research on small-scale robots has benefited tremendously from prior technological advances in MEMS. This journey started in 1980s where the vision of silicon chip-based robots with onboard sensors, actuators, and power supplies was proposed. Today, the challenge remains: how do we power these micro marvels and equip them with sufficient force to perform their tasks? The initial segment of this workshop will explore cutting-edge sensors and actuators, novel manufacturing methods, and creative strategies to address the energy limitations inherent in small-scale robotic systems.

The progress in small-scale robotics opens a dialogue about the creation of artificial agents that emulate the capabilities of their biological counterparts. In nature, the collective behaviors of simple agents—like ant colonies, bee hives, and schools of fish—illustrate how local interactions can lead to complex group dynamics, where the system as a whole is greater than the sum of its parts. Small-scale robots, with their compact dimensions and cost-effectiveness, serve as ideal platforms for exploring embodied and swarm intelligence. The workshop's second session will convene experts in swarm robotics, with a particular emphasis on micro-robots, to highlight the latest progress from theory to real-world applications in swarm design, fabrication, actuation, and coordination.

SEMI MSIG INDUSTRY SESSION: NAVIGATING THE TRANSITION TO INDUSTRY

Tuesday - 14:00 - 16:00 - Santee Ballroom

Join us for an immersive Industry Session designed to help graduate students navigate the transition from academia to industry. This event is hosted by SEMI MEMS and Sensors Industry Group (MSIG), a trade organization that brings together key players from across the ecosystem to address common challenges, explore emerging trends, and drive industry growth.

Gain practical advice, success strategies, and learn about the nuances of industry roles that are often overlooked in academia, as well as the variety of roles both in and out of the fab. Learn how to leverage your academic background while adapting to the dynamic demands of the industry. Engage with seasoned industry executives as they share firsthand experiences and advice. Participate in breakout sessions facilitated by rising stars in the industry. Don't miss this exclusive opportunity to expand your professional network, gain invaluable industry insights, and chart a successful career path in the MEMS and sensors sector.

BEYOND TECHNICAL EXPERTISE: DEALING WITH SOURCES OF PERSONAL AND PROFESSIONAL STRESS

Tuesday - 14:00 - 16:00 - Savannah Jr. Ballroom

We use short dramatizations supplemented with extensive discussion to explore stressful non-technical issues that often arise in the high-tech life. Specifically, we focus on three topics: power imbalance during peer review, when a junior investigator is asked to review a paper by a senior person, and there is a question of originality of the work; microaggressions, behaviors that create personal discomfort, whether intended or accidental; and the imposter syndrome, feelings of personal or professional inadequacy that can arise when exploring uncharted territory.

WEDNESDAY RUMP SESSION

Wednesday - 20:00 - 22:00 - Santee Ballroom

The 40th anniversary rump session hopes to capture classic aspects of the Hilton Head experience. To kick things off, attendees will be asked to test their knowledge on all aspects of microsystems, and Hilton Head. Try to find yourself in a diverse group to maximize your success! Amidst the trivia, serious discussion will be had on important topics in our field. Of course, no anniversary would be complete without special guests and toasts. As usual, snacks and beverages will be provided. So, you bring the Chips (Act), we will bring the salsa. This session is open to all attendees.

Sunday, 2 June

Workshop 1 MEMS Know Howe

- 10:00** **HOWE MEMS REALLY TOOK OFF**
Kurt Petersen, Silicon Valley Band of Angels, USA
- MICROFABRICATED ELECTROSTATIC COMB DRIVE**
William Tang, University of California, Irvine, USA
- HOWE POLYSILICON SURFACE MICROMACHINING
TRANSFORMED INERTIAL MEMS**
Michael Judy, Consultant, USA
- INTEGRATION OF MEMS AND CMOS**
Gary Fedder, Carnegie Mellon University, USA
- ADHESION AND ADHESION REDUCTION PROCESSES IN
SURFACE MICROMECHANICAL STRUCTURES**
Roya Maboudian, University of California, Berkeley, USA
- MICROASSEMBLY PROCESSES**
Karl Bohringer, University of Washington, USA
- 12:00** Lunch
- 13:00** **MEMS RESONATORS AND OSCILLATORS**
Clark Nguyen, University of California, Berkeley, USA
- HOWE SILICON MEMS RESONATORS BEGAN THE PATH TO
TIMING PRODUCTS**
Tom Kenny, Stanford University, USA
- MEMS VIBRATORY GYROSCOPES ARE BECOMING 3D AND
ATOMICALLY PRECISE**
Andrei Shkel, University of California, Irvine, USA
- OPTICAL MEMS**
Olav Solgaard, Stanford University, USA
- APPLICATION OF ULTRATHIN ALD PLATES**
Igor Bargatin, University of Pennsylvania, USA
- SIMPLIFYING BIOASSAY DEVELOPMENT WITH QES**
Chaitanya Gupta, Probius, USA
- SUMMARY AND WRAP-UP**
Roger Howe, Stanford University, USA
- 15:00** **Adjourn**

Workshop 2 Small-Scale Robots: From One to a Swarm

- 11:00** **Morning Session**
- 13:00** Lunch
- 15:30** **Afternoon Session**
- 17:00** **Adjourn**

Speakers:

Kristofer Pister, University of California, Berkeley, USA
Amit Lal, Cornell University, USA
Di Ni, Princeton University, USA
Steven Ceron, Massachusetts Institute of Technology, USA
Ronald Heisser, Massachusetts Institute of Technology, USA

- 18:00 -** **Registration and Welcome Reception**
21:00





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Topics of Particular Interest

Including, but not limited to:

- Micro-nano sensors and actuators
- MEMS and NEMS materials, fabrication and packaging
- Applied sciences of micro-nano systems
- Micro-nano mechanics, structures and modeling

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Monday, 3 June

07:00 **Breakfast**

07:45 **Welcome**

TRF President - Reza Ghodssi, University of Maryland

Workshop Chair - Jenna Chan, DEVCOM Army Research Laboratory

Program Chair - Swaminathan Rajaraman, University of Central Florida

Plenary Speaker I

Session Chair: Shawana Tabassum, University of Texas, Tyler, USA

08:15 **IoT4Ag AGRICULTURAL LEAF AND SOIL SENSORS**
Cherie R. Kagan, Ph.D., Roy H. Olsson, and Kevin T. Turner
University of Pennsylvania, USA

Session 1 - Microsystems for Biosensing

Session Chair: Igor Paprotny, University of Illinois, Chicago, USA

08:55 **INGESTIBLE DEVICE FOR NOISE-RESILIENT BIOIMPEDANCE MONITORING IN GASTROINTESTINAL TRACT**
Brian M. Holt¹, Justin M. Stine¹, Luke A. Beardslee¹, Jay Pasricha², and Reza Ghodssi¹
¹University of Maryland, USA and ²Mayo Clinic, USA,

09:15 **MICROFABRICATION AND CHARACTERIZATION OF A NOVEL 3D MITOCHONDRIA BIOSENSOR**
Randall James, Isaac Johnson, Ji Chang, Jorge Manrique Castro, and Swaminathan Rajaraman
University of Central Florida, USA

09:35 **ELECTRONIC-FREE TRACEABLE SMART CAPSULE FOR GASTROINTESTINAL MICROBIOME SAMPLING**
Devendra Sarnaik, Sina Nejati, Sarath Gopalakrishnan, Venkat Kasi, Akshay Krishnakumar, Samuel Hyde, Robyn McCain, Kinam Park, Jay S. Johnson, and Rahim Rahimi
Purdue University, USA

09:55 **ULTRA-SENSITIVE ON-CHIP GRAPHENE-BASED ELECTRO-OPTIC SENSOR ARRAYS FOR MULTIPLEXED NEURAL SIGNAL DETECTION**
Xiang Li, Zabir Ahmed, Harshvardhan Gupta, Kanika Sarna, Vishal Jain, and Maysam Chamanzar
Carnegie Mellon University, USA

10:15 am **Break and Tabletop Inspection**

10:44 am Wen Ko Technical Leadership Award Announcement

Invited Speaker I

Session Chair: Kirsten Kaplan, Facebook, USA

**10:45 FORTY YEARS OF MEMS INNOVATION AT HILTON HEAD
WORKSHOP: FROM EMERGING TECHNOLOGIES TO
COMMERCIAL PRODUCTS**

Alissa M. Fitzgerald, Ph.D.

AMFitzgerald & Associates, LLC, USA

Session 2 - Industrial, Higher TRL Microsystems

Session Chair: Thomas Li, NXP Semiconductors, USA

**11:15 CARDIOPULMONARY AUSCULTATION SYSTEM ENABLED BY
A NOVEL BEYOND-RESONANCE SENSING ACCELEROMETER**

Tzeno Galchev¹, Longwei Xiao², Wenyong Zhang², Haozhe Dong²,
Jianglong Zhang¹, James Lin¹, Zhengxin Zhao¹, Adam Spier¹,
Jin Peng³, Hua Jiang⁴, Khiem Nguyen¹, and Sam Zhang¹

*¹Analog Devices Inc., USA, ²Catron Inc., USA, ³Sichuan University,
CHINA, and ⁴Sichuan Provincial People's Hospital, CHINA,*

**11:35 A MEMS-BASED ANALOG COMPUTER FOR EDGE AI
COMPUTING**

David Lin¹, Johan M. Reimann¹, Dorin E. Calbaza¹,
Robert J. MacDonald¹, Zhihui Yang¹, Abdallah K. Alzubi²,
Mohammad S. Megdadi², and Fadi M. Alsaleem²

¹GE Aerospace Research, USA and

²University of Nebraska-Lincoln, USA

**11:55 NESTED-MEMS TEMPERATURE COMPENSATED SINGLE-
CRYSTALLINE SILICON OSCILLATOR**

Amir Rahafrooz, Diego Emilio Serrano, Ryan Hennessy,
William McDonald, Duane Younkin, Kieran Nunan, Stanley Che,
and Ijaz Jafri

Panasonic Massachusetts Laboratory, USA

12:15 Oliver Brand Remembrance

12:20 Poster Preview – Session 1

Session Chairs:

Hengky Chandralalim, Air Force Institute of Technology, USA

Siddhartha Ghosh, Northeastern University, USA

**12:45 - Networking Lunch
14:15**

Poster Session 1

Session Chair: Reza Ghodssi, University of Maryland, USA

14:15

Contributed and Late News

See page 13 for listing of poster presentations

16:45 pm End of Day



Tuesday, 4 June

07:30 **Breakfast**

08:00 **Announcements**

Plenary Speaker II

Session Chair: Amit Lal, Cornell University, USA

08:05 **HYBRID LOW LOSS INTEGRATED PHOTONICS: FROM CHIPSCALE FREQUENCY COMBS, FREQUENCY AGILE LASERS, ERBIUM AMPLIFIERS TO CRYOGENIC QUANTUM INTERCONNECTS**

Tobias Kippenberg, Ph.D.

*Swiss Federal Institute of Technology Lausanne (EPFL),
SWITZERLAND*

Session 3 - Resonators, Oscillators and Micromotors

Session Chairs: Azadeh Ansari, Georgia Institute of Technology, USA and
Vikrant Gokhale, Navy Research Laboratory, USA

08:45 **Q-ENHANCEMENT OF PIEZO-ON-SILICON MEMS RESONATORS THROUGH MODE-COUPLING AND TOPOLOGICAL TANK CONFIGURATIONS**

Suaib Tariq Balghari, Abid Ali, and Frederic Nabki
Ecole de Technologie Supérieure, CANADA

09:05 **ULTRA-STABLE MEMS OSCILLATOR WITH 42 PPT FRACTIONAL FREQUENCY STABILITY AT 85 SECONDS**

Jintark Kim¹, Rakibul Islam¹, Jiheng Jing¹, Jie Yan¹,
Gabrielle Vukasin², Ryan Kwon², Saurabh Saxena^{1,3},
Thomas W. Kenny², Pavan K. Hanumolu¹, and Gaurav Bahl¹
¹University of Illinois, Urbana-Champaign, USA, ²Stanford University,
USA, and ³Indian Institute of Technology, INDIA

09:25 **ANALOG MICRO DELTA ($\mu\Delta$) MOTOR: COMPLIANT MECHANISM ENABLED MEMS BIDIRECTIONAL TRANSMISSION-CAPABLE GAP CLOSING ARRAY**

Alexander N. Alvara, Yichen Liu, Liwei Lin,
and Kristofer S. J. Pister
University of California, Berkeley, USA

9:55 am **Break and Tabletop Inspection**

10:14 am Denice Denton Mentorship Award Announcement

Invited Speaker II

Session Chair: Ravi Selvaganapathy, McMaster University, CANADA

**10:15 CHANGING THE COURSE OF HEART FAILURE DISEASE
MANAGEMENT USING MEMS – A CARDIOMEMS STORY**

Michael A. Fonseca, Ph.D.

StethX Microsystems, USA

Session 4 - Chemical and Environmental Sensing

Session Chairs: Daniela Diaz-Alonso, Center for Engineering and Industrial Development (CIDESI), MEXICO and Rahim Rahimi, Purdue University, USA

**10:45 AN ELECTROLYTIC-INDUCED BUBBLE-BASED DISSOLVED
CO₂ SENSOR**

Steven Tran, Seungbeom Noh, and Hanseup Kim

University of Utah, USA

**11:05 MULTI-MODAL MEMS SENSING MODULE FOR
EXTRATERRESTRIAL OCEANOGRAPHIC EXPLORATION**

Zhijian Hao¹, Yue Zheng¹, Ethan W. Schaler², and Azadeh Ansari¹

¹*Georgia Institute of Technology, USA and*

²*Jet Propulsion Laboratory, California Institute of Technology, USA,*

**11:25 PAPER-BASED WEARABLE MOIST-ELECTRIC GENERATORS
WITH EFFICIENT ATMOSPHERIC WATER CAPTURE**

Yang Gao, Anwar Elhadad, and Seokheun Choi

State University of New York, Binghamton, USA

**11:45 Hilton Head Education, History, and Conservation Talk
The Civil War on Hilton Head Island: Local History, National
Impact, Enduring Legacy**

Jan McKelvey

Lean Ensemble Theater, USA

**12:15 - Networking Lunch
13:30**

**14:00 - SEMI MSIG Industry Session:
16:00 Navigating the Transition to Industry**

**14:00 - Workshop: Beyond Technical Expertise: Dealing with
16:00 Sources of Personal and Professional Stress**

14:00 - Recreational Activities (on your own)

19:00

18:00 - Student Sandcastle Building Event

19:00

19:00 - Banquet

22:00



Wednesday, 5 June

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

7:30 am **Breakfast**

8:10 am **Announcements**

Plenary Speaker III

Session Chair: Reza Ghodssi, University of Maryland, USA

08:15 **SENSORS, ROBOTS, AND AI FEEDBACK DATA LOOPS:
POWERING JOINT REPLACEMENT SURGERIES OF THE
FUTURE**

Christopher J. Cannova, M.D.

Aligned Orthopedic Partners, USA

Session 5 - Medical MEMS

Session Chairs: Kevin Daniels, University of Maryland, USA and
Virgilio Valente, Toronto Metropolitan University, CANADA

08:55 **AN APPROACH FOR 3D MICROPRINTING OF SOFT ROBOTIC
BIOPSY TOOLS AT 1 FRENCH LENGTH SCALES VIA *EX SITU*
DIRECT LASER WRITING**

Sunandita Sarker^{1,2}, Declan Fitzgerald¹, Zachary Ferraro¹,
Olivia M. Young¹, Bailey M. Felix¹, and Ryan D. Sochol¹

¹*University of Maryland, USA and*

²*University of Massachusetts, USA*

09:15 **FLEXIBLE MICROINJECTOR FOR RAPID LOCALIZED DRUG
DELIVERY FROM INGESTIBLE DEVICES**

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

University of Maryland, USA

09:35 **MAGNETIC FIELD SENSING WITH A MINIATURE ELECTRO-
OPTIC SENSOR FOR INTERVENTIONAL MAGNETIC
RESONANCE IMAGING**

Alp A. Derin¹, Abhiram Pulavarthi¹, Jordan L. Edmunds²,
Jack Guida¹, Siddhartha Ghosh¹, and Soner Sonmezoglu¹

¹*Northeastern University, USA and*

²*University of California, Berkeley, USA*

09:55 **ULTRASOUND-BASED TELEMETRY OF IMPLANTED MICROFLUIDICS FOR INTRACRANIAL PRESSURE SENSING**
Cecilia A. Luna^{1,2}, Saeyoung Kim², Adeoye Olomodosi^{1,2},
Nicholas Au Yong^{1,2}, Brooks D. Lindsey^{1,2}, and David R. Myers^{1,2}
¹Emory University, USA and ²Georgia Institute of Technology, USA,

10:15 **Break and Tabletop Inspection**

10:44 **Mark Shannon Grand Challenges Award Announcement**

Invited Speaker III

Session Chair: Shaurya Prakash, Ohio State University, USA

10:45 **EMPOWERING PEOPLE TO TAKE CONTROL OF HEALTH**
Joshua Windmiller, Ph.D.
Dexcom, USA

Session 6 - Novel Devices

Session Chair: Farnaz Niroui, Massachusetts Institute of Technology, USA

11:15 **POSS-ENABLED MECHANICAL ENHANCEMENT FOR 3D-NANOPRINTED HIGH-ASPECT-RATIO MICROINJECTION NEEDLES**
Adira Colton¹, Sunandita Sarker¹, A. Muhaymin Chowdhury¹,
Prableen Chowdhary², Joshua A. Levy¹, Katie L. Rusland¹,
Reza Ghodssi¹, Rachel Brewster², Kinneret Rand-Yadin³,
and Ryan D. Sochol¹
¹University of Maryland, College Park, USA, ²University of Maryland, Baltimore County, USA, and ³SeeTrue Technology, LLC, USA

11:35 **AFTER 90 YEARS: CMOS-BASED HAFNIA-ZIRCONIA NANOMECHANICAL RESONATOR EXCEEDING AT-CUT QUARTZ TEMPERATURE STABILITY**
Troy Tharpe, Moumita Chakraborty, and Roozbeh Tabrizian
University of Florida, USA

11:55 **ULTRACOMPACT AND HIGH-GAIN THIN-FILM BULK ACOUSTIC RESONATOR MAGNETOELECTRIC ANTENNA ARRAY**
Bin Luo¹, Xianfeng Liang¹, Huaihao Chen¹, Neville Sun¹,
Hwaider Lin², and Nian X. Sun¹
¹Northeastern University, USA and ²Winchester Technologies LLC, USA,

12:15 **Poster Preview – Session 2 Commercial Posters**
Session Chairs:
Mary Beth Galanko Klemash, DEVCOM Army Research Laboratory, USA
Swaminathan Rajaraman, University of Central Florida, USA

13:00 - **Networking Lunch**
14:30

Poster Session 2
Session Chair: Jenna Chan, DEVCOM Army Research Laboratory, USA

14:30 **Contributed and Late News**

17:00 - **Free Time**

Poster Session 3 and Reception
Session Chair: Sina Askari, ECS/DARPA, USA

18:30 **Commercial and Open Posters**

20:00 - **Rump Session**
22:00



Thursday, 6 June

07:30 **Breakfast**

08:10 **Announcements**

Plenary Speaker IV

Session Chair: Kari Moran, Naval Information Warfare Center Pacific, USA

08:15 **MICRO INNOVATIONS, MACRO IMPACT:
MEMS AT THE FOREFRONT OF OUR ENERGY FUTURE**
Evelyn N. Wang, Ph.D.
ARPA-E, USA

Session 7 - Novel Devices and Processes

Session Chair: Logan Sorenson, HRL Laboratories, USA

08:55 **FABRICATION OF SUPERHYDROPHOBIC STRUCTURES VIA
AEROSOL JET PRINTING**

Jace Rozsa¹, Ke Zhong¹, Dinesh K. Patel¹, Lining Yao²,
Mohammad F. Islam¹, and Gary K. Fedder¹

¹*Carnegie Mellon University, USA and*

²*University of California, Berkeley, USA*

09:15 **TRANSLATION AND ELECTRICALLY CONTROLLED ROTATION
OF LARGE ZEBRAFISH EMBRYO BY ACOUSTIC TWEEZERS**

Baptiste Neff, Kianoush Sadeghian Esfahani, Akash Roy,
Matin Barekatain, and Eun S. Kim

University of Southern California, Los Angeles, USA

09:35 **LOCALIZED AND CONFORMAL STRAIN ENGINEERING OF 2D
MATERIALS FOR SCALABLE, FUNCTIONAL DEVICES**

Sarah O. Spector, Weikun Zhu, Alex Quach, Peter F. Satterthwaite,
and Farnaz Niroui

Massachusetts Institute of Technology, USA

09:55 **Break and Tabletop Inspection**

Invited Speaker IV

Session Chair: Vladimir Aksyuk, National Institute of Standards and Technology, USA

10:25 **DECADES OF MEMS TIMING**
Ginel C. Hill, Ph.D., Gary K. Giust, and Markus Lutz
SiTime Corporation, USA

Session 8 - Late News

Session Chair: Kimberly Harrison, AMFitzgerald, USA

- 10:55 A NOVEL THIN FILM ENDOVASCULAR ELECTRODE ARRAY FOR MINIMALLY INVASIVE NEURAL RECORDING**
Brianna Thielen¹, Huijing Xu¹, Pradeep Selvan², Charles Liu¹, William J. Mack¹, Dong Song¹, and Ellis Meng¹
¹*University of Southern California, Los Angeles, USA* and
²*Lundquist Institute for Biomedical Innovation, USA*
- 11:15 AN AGING COMPENSATED ALSCN-ON-SI BULK ACOUSTIC WAVE OSCILLATOR TOWARDS TACTICAL-GRADE CLOCK GENERATION**
Banafsheh Jabbari, Shaurya Dabas, Dicheng Mo, Eitan. HersHKovitz, Honggyu Kim, and Roozbeh Tabrizian
University of Florida, USA
- 11:35 INGESTIBLE BIOIMPEDANCE SENSING DEVICE FOR LOCALIZED FEEDBACK-DRIVEN DRUG DELIVERY**
Mateo W. Lim, Brian M. Holt, Joshua A. Levy, Justin M. Stine, Luke A. Beardslee, and Reza Ghodssi
University of Maryland, USA
- 12:10 Award Ceremony**
- 12:10 Closing Remarks**
Workshop Chair - Jenna Chan, DEVCOM Army Research Laboratory
Program Chair - Swaminathan Rajaraman, *University of Central Florida*
- 12:45 - 14:15 Networking Lunch**
- 14:15 Workshop Adjourns**

Poster Presentations - Session 1

Contributed and Late News Posters
Monday, 3 June 14:15– 16:45

Chemical or Biological Sensors, Actuators or Systems

- MP-01** **A HIGHLY SENSITIVE FLEXIBLE AG NPS/MWCNTS/NAFION-RU(NH₃)₆^{3+/2+} ELECTRODE WITH SU-8 MICROPILLARS FOR REAL-TIME HYDROGEN SULFIDE MONITORING IN LIQUIDS**
Chih-Hsiang Su¹, Mu-Yi Fang¹, Ting-Wei Huang¹, Yu-Ting Cheng¹, Hsiao-En Tsai², and Yih-Shurng Chen²
¹National Yang Ming Chiao Tung University, TAIWAN and
²National Taiwan University Hospital (NTUH), TAIWAN
- MP-02** **ADVANCED PAPER-BASED ORGANIC ELECTROCHEMICAL TRANSISTORS: A NOVEL APPROACH FOR RAPID POINT-OF-CARE ANTIBIOTIC SUSCEPTIBILITY TESTING**
Zahra Rafiee, Maryam Rezaie, and Seokheun Choi
State University of New York, Binghamton, USA
- MP-03** **DUAL-MODE SENSING PLATFORM FOR DETECTION OF INFLAMMATORY BIOMARKER IN MONITORING ORGAN TRANSPLANT REJECTION**
Atul Sharma, Nafize Ishtiaque Hossain, and Sameer Sonkusale
Tufts University, USA
- MP-04** **EXTENDED FLIGHT DURATION SMALL-SCALE QUADROTORS POWERED BY HIGH-ENERGY-DENSITY, HIGH-POWER-DENSITY MICRO ALUMINUM-AIR BATTERIES**
Yanghang Huang, Haoxuan Lyu, Mark G. Allen, and Sue Ann Bidstrup Allen
University of Pennsylvania, USA
- MP-05** **FLEXISENSE: PH-GUIDED PRECISION DRUG DELIVERY AND MONITORING USING FLEXIBLE ELECTRONIC TECHNOLOGY**
Akshay Krishnamumar, Masud Rana Muhammad, Sarath Gopalakrishnan, Jose Waimin, and Rahim Rahimi
Purdue University, USA,
- MP-06** **INTEGRATION OF HYDROGEL MICROFIBERS FOR HYBRID LEAD SEQUESTRATION AND SENSING IN CROP PLANTS: A NOVEL APPROACH FOR PHYTOREMEDIATION**
Rhythem Tahrin, Francisco Perez, Mohammad Solaiman, Md Najmul Islam, Shah Zayed Riam, and Shawana Tabassum
University of Texas, Tyler, USA

- MP-07** **NFC-ENABLING SMARTPHONE-BASED PORTABLE PHOTOTHERMAL SENSING INTEGRATED WITH PAPER-BASED MICROFLUIDIC DEVICES FOR ENZYME-FREE GLUCOSE DETECTION**
 Kawin Khachornsakkul, Ruben Del-Rio-Ruiz, Cihan Asci, and Sameer Sonkusale
Tufts University, USA
- MP-08** **PROBIOTIC-POWERED INGESTIBLE CAPSULES: A NOVEL APPROACH TO VIBRATIONAL THERAPY**
 Maryam Rezaie and Seokheun Choi
State University of New York, Binghamton, USA
- MP-09** **RAPID, LOW-COST CARBAPENEMASE DETECTION USING A SELF-COALESCEING STICKER MICROFLUIDIC FOR ENHANCED MANAGEMENT OF CARBAPENEMASE-PRODUCING ORGANISMS IN HEALTHCARE SETTINGS**
 Anjana Dissanayaka^{1,2}, Ali Haider³, Lily Kamat^{1,2}, Priscilla Delgado^{1,2}, Jesse Waggoner³, and David R. Myers^{1,2}
¹Emory University, USA, ²Georgia Institute of Technology, USA, and ³Emory University School of Medicine, USA
- MP-10** **FIBEROPTICS SERS BIOSENSORS FOR SALMONELLA SENSING**
 Mai Abuhelwa¹, Arshdeep Singh¹, Jiayu Liu¹, Mohammed Almalaysha¹, Kate E. Trout¹, Amit Morey², E. Kinzel³, Lakshmikantha H. Channaiah¹, and Mahmoud Almasri¹
¹University of Missouri, Columbia, USA, ²Auburn University, USA, and ³University of Notre Dame, USA
- MP-11** **ULTRA THIN SMART ELECTROPALATOGRAPHY SYSTEM TO ASSIST LINGUISTIC AND MEDICAL DIAGNOSIS**
 Ziqi Jia, Sunghyun Hwang, Saeyeong Jeon, Ariel David Cerpa, and Yong-Kyu “YK” Yoon
University of Florida, USA

Physical Sensors, Actuators, or Systems

- MP-12** **2 TO 16 GHZ FUNDAMENTAL SYMMETRIC MODE ACOUSTIC RESONATORS IN PIEZOELECTRIC THIN-FILM LITHIUM NIOBATE**
 Vakhtang Chulukhadze, Jack Kramer, Tzu-Hsuan Hsu, Omar Barrera, Ian Anderson, Sinwoo Cho, Joshua Campbell, and Ruochen Lu
University of Texas, Austin, USA

- MP-13 A LOW-PHASE NOISE OSCILLATOR EMPLOYING CONTOUR-MODE LITHIUM TANTALATE RESONATORS WITH HIGH TURNOVER TEMPERATURE**
 Tanvir Hasan, Yasaman Majd, Hamed Atashbar, Hannaneh Mahdavi, Hakhamanesh Mansoorzare, and Reza Abdolvand
University of Central Florida, USA
- MP-14 A PARAMETRIC FREQUENCY COMB GENERATOR IMPROVING BY 10X THE LIMIT-OF-DETECTION OF 120 MHZ ALSCN-BASED IR DETECTORS**
 Hussein M. E. Hussein¹, Farah Ben Ayed², Aurelio Venditti², Pietro Simeoni², Zhenyun Qian², Cristian Cassella¹, and Matteo Rinaldi²
¹Northeastern University, USA and ²NS&NS Laboratory & Institute of NanoSystems Innovation, USA
- MP-15 AI-DRIVEN SCANNING GHZ ULTRASONIC IMAGING-BASED MEMS METROLOGY**
 Karan Jha¹, Anuj Baskota¹, Justin Kuo¹, Serhan Ardanuç¹, Scott Zimmerman¹, and Amit Lal^{1,2}
¹Geegah Inc, USA and ²Cornell University, USA,
- MP-16 CO-RESONANT CANTILEVERS AS HIGHLY SENSITIVE MASS SENSORS**
 Ioannis Lampouras and Julia Körner
Leibniz University Hannover, GERMANY
- MP-17 DESIGN AND FABRICATION OF A NOVEL THERMALLY-ACTUATED NO ELECTRIC POWER EVENT-DRIVEN MEMS SENSOR FOR IOT APPLICATIONS**
 Dilan Ratnayake and Kevin M. Walsh
University of Louisville, USA
- MP-18 DESIGN AND FABRICATION OF SWITCH BASED BIO-INSPIRED AIRFLOW SENSORS**
 Bram Miller, Regan Kubicek, and Sarah Bergbreiter
Carnegie Mellon University, USA
- MP-19 ENHANCING TEMPERATURE STABILITY OF LAMÉ-MODE SILICON RESONATOR USING ELASTIC NONLINEARITY**
 Dicheng Mo, Shaurya Dabas, Banafsheh Jabbari, and Roozbeh Tabrizian
University of Florida, USA

- MP-20 FLUX CONCENTRATOR OPTIMIZATION EXPLOITING SATURATION FOR MICROMACHINED AC MAGNETIC FIELD SENSORS**
Xuan Wang, Sydney Sofronici, Roy H. Olsson, and Mark G. Allen
University of Pennsylvania, USA
- MP-21 GRAVIMETRIC PARTICULATE MATTER SENSING WITH PIEZOELECTRIC PAPER**
Anindya L. Roy, Kanagasubbulakshmi Sankaralingam, Konrad Walus, and Boris Stoeber
University of British Columbia, CANADA
- MP-22 INTERNAL RESONANCE OF A T-SHAPED ELECTROSTATIC LEVITATION ACTUATOR**
Mohammad Alzgoool, Yu Tian, Mohammad Younis, and Shahrzad Towfighian
Binghamton University, USA
- MP-23 MEMS LITHIUM NIOBATE TRANSFORMER FOR LOW FREQUENCY PASSIVE GAIN WITH HIGH CAPACITIVE LOADS IN ATMOSPHERE**
Justin Phelps and Reza Abdolvand
University of Central Florida, USA
- MP-24 MID-AIR PARTICLE MANIPULATIONS BY A 2x2 PMUT ARRAY**
Wei Yue¹, Megan Teng¹, Yande Peng¹, Fan Xia¹, Peggy Tsao¹, Yuan Gao¹, Shinsuke Ikeuchi², Yasuhiro Aida², Seiji Umezawa², and Liwei Lin¹
¹*University of California, Berkeley, USA and*
²*Murata Manufacturing Co., Ltd., JAPAN,*
- MP-25 NONLINEAR INTERNAL RESONANCE FOR GAS SENSING**
Wagner B. Lenz¹, Rodrigo T. Rocha^{1,2}, Fahimullah Khan^{1,3}, Carlos A. Grande¹, and Mohammad I. Younis^{1,4}
¹*King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA,* ²*Silicon Austria Labs (SAL), AUSTRIA,* ³*International Iberian Nanotechnology Laboratory Braga, PORTUGAL,* and ⁴*State University of New York, Binghamton, USA*
- MP-26 PARASITIC-IMMUNE REAL-TIME TRACKING OF A MEMS FREQUENCY REFERENCE**
Jie Yan¹, Jintark Kim¹, Rakibul Islam¹, Jiheng Jing¹, Dongsuk D. Shin², Saurabh Saxena^{1,3}, Pavan Hanumolu¹, Thomas W. Kenny², and Gaurav Bahl¹
¹*University of Illinois, Urbana-Champaign, USA,* ²*Stanford University, USA,* and ³*Indian Institute of Technology, INDIA*

- MP-27 SCANDIUM ALUMINUM NITRIDE OVERMODED BULK ACOUSTIC RESONATORS FOR FUTURE WIRELESS COMMUNICATION**
Walter Gubinelli, Pietro Simeoni, Ryan Tetro, Luca Colombo, and Matteo Rinaldi
Northeastern University, USA
- MP-28 SPARSE ARRAY OF THERMAL RESONATORS FOR INFRARED DETECTION AND IMAGING**
Isabel H. Rodrigues¹, Clifford F. Frez¹, Savannah R. Eisner^{2,3}, Debbie G. Senesky², and Mina Rais-Zadeh¹
¹*California Institute of Technology, USA*, ²*Stanford University, USA*, and ³*Columbia University, USA*
- MP-29 TRAMPOLINE Si₃N₄ MAGNETOMETERS WITH 330 PT/Hz SENSITIVITY**
Massood Tabib-Azar and Brian Baker
University of Utah, USA
- MP-30 ULTRA-WIDEBAND TAPERED TRANSDUCERS IN THIN-FILM LITHIUM NIOBATE ON SILICON CARBIDE**
Jack Kramer, Tzu-Hsuan Hsu, Joshua Campbell, and Ruochen Lu
University of Texas, Austin, USA

Technology, Materials, Packaging, and CAD

- MP-31 3D PRINTED MICRO LIQUID THERMAL REGULATOR (MLTR) FOR *IN-VIVO* CHRONIC PAIN APPLICATIONS**
Jazune Madas, Andre Childs, Jichao Ma, Jin Chen, Lei Zhai, Zixi Jack Cheng, and Swaminathan Rajaraman
University of Central Florida, USA
- MP-32 ADVANCING MILLIMETER-WAVE TECHNOLOGIES: HIGH-EFFICIENCY 3D AIR-LIFTED INDUCTORS FEATURING A HIGHLY MANUFACTURABLE CU/CO META CONDUCTOR**
Saeyeong Jeon, Ariel David Cerpa, Alexander Wilcher, and Yong-Kyu Yoon
University of Florida, USA
- MP-33 ANALYSIS OF DIFFERENT MICROFLUIDIC PIN-FIN STRUCTURES IN METAL ADDITIVELY MICROFABRICATED PACKAGES FOR THERMAL MANAGEMENT OF MICROSYSTEMS**
Bhushan Lohani¹, Ryan M. Price², Peter Sanchez², and Robert C. Roberts²
¹*Pennsylvania State University, USA* and ²*University of Texas, El Paso, USA*

- MP-34 ENABLING CUT-RESISTANT SUPERHYDROPHOBIC SURFACES USING A HIGHLY ENTANGLED SOFT POLYMERIC SUBSTRATE**
Junce Cheng and Tingyi “Leo” Liu
University of Massachusetts, Amherst, USA
- MP-35 HIGHLY EFFICIENT, FLEXIBLE, AND SELF-HEALABLE MOISTURE-DRIVEN ENERGY HARVESTER BASED ON 2D VANADIUM PENTOXIDE NANOSHEETS**
Kundan Saha and Sameer Sonkusale
Tufts University, USA
- MP-36 LONG-LASTING LEVOTHYROXINE SODIUM MICRONEEDLE PATCH FOR HASHIMOTO’S THYROIDITIS TREATMENT**
Diana V. Rodriguez De Francisco, Edwin Davidson Barahona, Omar S. Cepeda Torres, and Swaminathan Rajaraman
University of Central Florida, USA
- MP-37 ON-DEMAND TRANSDERMAL DRUG DELIVERY PLATFORM BASED ON HOLLOW-GROOVE MICRONEEDLE ARRAY**
Jihyun Kim, Danilo M. dos Santos, Hasika Suresh, and Sameer Sonkusale
Tufts University, USA
- MP-38 SHRINKABLE SILICONE THIN MEMBRANES AND THEIR INTEGRATION IN 3D PRINTED MICROFLUIDIC OXYGENATORS**
Anand Sojan, Ponnambalam Ravi Selvaganapathy and Islam Hassan
McMaster University, CANADA
- MP-39 SUPERHARMONIC RESONANT RESPONSE MEASUREMENT (SRRM): A NEW METHOD FOR MEASURING SPONTANEOUS POLARIZATION**
Vishnu Kumar¹, Shreeraj Joshi¹, Sudhanshu Tiwari^{1,2}, Upanya Khandelwal¹, Rudra Pratap^{1,3}, Pavan Nukala¹, and Saurabh Chandorkar¹
¹*Indian Institute of Science, Bengaluru, INDIA*,
²*Purdue University, USA*, and ³*Plaksha University, INDIA*
- MP-40 TAILORING ENHANCEMENT OF SILICON DIOXIDE ADHESION TO POLYCARBONATE SUBSTRATES FOR 3D MICROELECTRODE ARRAYS (3D MEAS) AND OTHER BIOSENSORS**
Surbhi Tidke, Omar S. Cepeda-Torres, Pablo Morales-Cruz, Brian E. Butkus, Andre Childs, and Swaminathan Rajaraman
University of Central Florida, USA

**MP-41 TRANSFERRING SOFT DOUBLY RE-ENTRANT
MICROSTRUCTURES FOR MECHANICALLY RESILIENT
OMNIPHOBIC SURFACES**

Qingyang Sun and Tingyi “Leo” Liu
University of Massachusetts, Amherst, USA

**Late News - Chemical or Biological Sensors, Actuators or
Systems**

**MP-43 FLEXIBLE BIODEGRADABLE LEAF-WEARABLE SENSOR FOR
MONITORING STRESS-INDUCED METHANOL EMISSION FROM
PLANTS**

Elvis D. Sangmen¹, A K M Sarwar Inam¹, Shah Zayed Riam¹,
Md. Najmul Islam¹, Ariba Siddiqui², Mitradip Bhattacharjee²,
and Shawana Tabassum¹

¹*University of Texas, Tyler, USA* and ²*Indian Institute of Science
Education and Research (IISER), INDIA*

Late News - Physical Sensors, Actuators, or Systems

**MP-44 INTEGRATION OF GRAPHENE-POLYMER HETEROSTRUCTURE
MEMBRANES INTO A MULTI-USER MEMS FABRICATION
PROCESS**

Katherine Smith¹, Alaaeldin Elhady², Samed Kocer²,
Daniel M. Armada¹, Aidan Retallick¹, Matthias Heil¹,
Eihab M. Abdel-Rahman², and Aravind Vijayaraghavan¹

¹*University of Manchester, UK, and*

²*University of Waterloo, CANADA*

**MP-45 SENSITIVITY CONSIDERATIONS FOR A SMART HYDROGEL-
BASED MICROSENSOR FOR CATHETER APPLICATIONS**

Benozir Ahmed¹, Christopher F. Reiche¹, Florian Solzbacher¹,
and Julia Körner^{1,2}

¹*University of Utah, USA* and

²*Leibniz University Hannover, GERMANY*

**MP-46 X-BAND FREQUENCY SCALING OF A0 AND S0 FOCUSED
LAMB MODES FOR ACOUSTIC DELAY LINES IN 30%
SCANDIUM ALUMINUM NITRIDE**

Jack Guida, Gabriel Giribaldi, Matteo Rinaldi, and Siddhartha Ghosh
Northeastern University, USA

Late News - Technology, Materials, Packaging, and CAD

**MP-47 DEVELOPMENT OF ADVANCED DIABETIC ORTHOTICS:
FROM FINITE ELEMENT MODELING TO PRESSURE SENSOR
IMPLEMENTATION**

Jorge Manrique Castro¹, Monisha Elumalai¹,
Diana V. Rodriguez De Francisco¹, Isaac Johnson¹,
Swaminathan Rajaraman¹, and Charles M. Didier^{1,2}

¹*University of Central Florida, USA and*

²*Orthomerica Products Inc., USA*

**MP-48 FIRST CONTACT: DESIGN AND FABRICATION OF THE FIRST
3D PRINTED MEMS G-SWITCH**

Regan Kubicek¹, Joshua Tyler², Harvey Tsang², Gabriel Smith²,
Daniel Jean², and Sarah Bergbreiter¹

¹*Carnegie Mellon University, USA and*

²*DEVCOM Army Research Laboratory, USA*

**MP-49 TOPOLOGICALLY PROTECTED FANO RESONANCE IN A 80
MHZ SC-DOPED ALN THIN FILM RESONATOR WITH A
QUALITY FACTOR LARGER THAN 10K**

Xuanyi Zhao¹, Jacopo M. De Ponti², Tommaso Maggioli¹,
Marco Colangelo¹, Richard Craster³, and Cristian Cassella¹

¹*Northeastern University, USA, ²Polytechnic University of Milan,
ITALY, and ³Imperial College London, UK*



Poster Presentations - Session 2

Contributed and Late News Posters
Wednesday, 5 June 14:30– 17:00

Chemical or Biological Sensors, Actuators or Systems

- WP-01 A PIEZOELECTRIC MIDDLE-EAR MICROPHONE FOR COCHLEAR IMPLANTS**
Emma F. Wawrzyniek¹, John Z. Zhang¹, Ioannis Kymissis², Elizabeth S. Olson², Hideki Heidi Nakajima^{3,4}, and Jeffrey H. Lang¹
¹Massachusetts Institute of Technology, USA, ²Columbia University, USA, ³Harvard University, USA, and ⁴Mass Eye and Ear, USA,
- WP-02 AUTONOMOUS MICROFLUIDIC DEVICE FOR THE NAKED-EYE DETECTION OF BENZODIAZEPINES IN ADULTERATED BEVERAGES**
Isabel Poves-Ruiz¹, Enrique Azuaje-Hualde¹, Igor Corchado-Gonzalez¹, Lourdes Basabe-Desmonts^{1,2}, and Fernando Benito-Lopez¹
¹University of the Basque Country, SPAIN and ²IKERBASQUE, SPAIN
- WP-03 ELECTROCHEMICAL SENSORS FOR HEAVY METAL DETECTION USING PYROLYTIC CARBON AND GOLD ELECTRODES**
Yingming Xu, Peng Zhou, Terrence Simon, and Tianhong Cui
University of Minnesota, USA
- WP-04 FABRICATION OF SUBMICRON TUNABLE METAMATERIAL INFRARED ABSORBERS FOR GAS SENSING USING OPTICAL CONTACT LITHOGRAPHY**
Amirali Nikeghbal, Md Rabiul Hasan, Adwait Deshpande, Fatemeh Momeni, Seungbeom Noh, Hanseup Kim, and Carlos H. Mastrangelo
University of Utah, USA
- WP-05 INTEGRATION OF HYDROGEL ADHESIVE AND MICROSTRUCTURED DEVICE FOR VAGUS NERVE STIMULATION**
Jae Young Park, Jongcheon Lim, Carl R. Russell III, Pei-Lun Chen, Seokkyoon Hong, Chi Hwan Lee, and Hyowon Lee
Purdue University, USA

- WP-06 MULTIFUNCTIONAL FINGERPRINTING OF INDIVIDUAL FIBROBLASTS USING MEMS-BASED DEVICES**
 Ji Chang¹, Omar Cepeda-Torres¹, Saqib Shahzad¹, Guntis Rutins¹, Richard G. Blair¹, Swaminathan Rajaraman¹, and Laurene Tetard^{1,2}
¹*University of Central Florida, USA and*
²*Universite Claude Bernard Lyon, FRANCE*
- WP-07 NOVEL PASSIVE INTRACRANIAL PRESSURE SENSOR USING ULTRASOUND READOUT**
 Colleen A. Chemerka, Juan P. Botero-Torres, Navid Farhoudi, Prattay D. Kairy, Simon Binder, Florian Solzbacher, Lars B. Laurentius, and Christopher F. Reiche
University of Utah, USA
- WP-08 RAPID POINT-OF-CARE LFA DIAGNOSTICS FOR ORAL HEALTH USING OPTICAL EXCITATION/DETECTION METHODS**
 Daewoo Han, Der Vang, Adewale Adehinmoye, Lyndsay Kissell, Pietro Strobbia, and Andrew J. Steckl
University of Cincinnati, USA
- WP-09 SCALABLE ELECTROPOLYMERIZATION OF VERTICAL GRAPHENE OXIDE ELECTRODES AS A PHYSICAL/CHEMICAL BIOSENSOR PLATFORM**
 Amani Salim¹, Farihin Adzlan¹, Haris Lotfi¹, Iman Ismail¹, Adam Zahanuddin¹, Sazwin Ishak¹, Malini Kanapathy¹, Pretha Selvam¹, Iqbal Shamsul¹, and D. Marshall Porterfield²
¹*University Malaya, MALAYSIA and* ²*Purdue University, USA,*
- WP-10 TRI-COMPARTMENT CHIP WITH MICROELECTRODE ARRAY AND DR1-GLASS GROOVES FOR NEURONAL CELL ALIGNMENT**
 Tomi Ryyänänen, Chiara Fedele, Anna-Mari Moilanen, Jorma Vihinen, Lassi Sukki, Kaisa Tornberg, Saara Haikka, Susanna Narkilahti, Arri Priimagi, and Pasi Kallio
Tampere University, FINLAND
- WP-11 VERTICAL MICRO-NANOCHANNEL INTEGRATION FOR RELATIVE SURFACE PROTEIN ABUNDANCE QUANTIFICATION ON LIPOSARCOMA EXTRACELLULAR VESICLES**
 Premanshu K. Singh, Ali F. Usmani, Patricia Sarchet, Raphael Pollock, and Shaurya Prakash
Ohio State University, USA

Physical Sensors, Actuators, or Systems

- WP-12 2-SNESAT: SCALABLE BEHAVIOR-DIFFERENTIATED CONTROL FOR SWARMS OF PROGRAMMABLE MEMS MICROROBOTS**
Ratul Majumdar, Milos Zefran, and Igor Paprotny
University of Illinois, Chicago, USA
- WP-13 A METHOD TO EXTRACT AND MODEL STRUCTURAL ASYMMETRIES IN DUAL-SHELL GYROSCOPES TO STUDY FREQUENCY DEGENERACY**
Lois Meira Lopez, Danmeng Wang, Austin R. Parrish, and Andrei M. Shkel
University of California, Irvine, USA
- WP-14 A SELF-POWERED MICRO TRIBOELECTRIC ACCELEROMETER WITH HIGH SENSITIVITY**
Mohammad Alzgoor¹, Yu Tian¹, Benyamin Davaji², and Shahrzad Towfighian¹
¹Binghamton University, USA and ²Northeastern University, USA,
- WP-15 CMOS-COMPATIBLE MICROFABRICATION OF LAMINATED NIFE CORES FOR WIRELESS POWER TRANSFER**
Xuan Wang, Sida Chen, Zihan Zhang, Lei Gu, and Mark G. Allen
University of Pennsylvania, USA
- WP-16 DEMONSTRATION OF FABRY-PEROT INTERFEROMETRY FOR PHOTOLITHOGRAPHY MASKS**
Md Iftekharul Islam¹, Amrid Amnache¹, Richard Beaudry², Maurice Delafosse², Serge Ecoffey¹, and Luc G. Fréchette¹
¹Université de Sherbrooke, CANADA and ²Digitho Technologies Inc., CANADA
- WP-17 DESIGN AND FABRICATION OF LIQUID METAL TACTILE SENSORS WITH ENHANCED SENSITIVITY AND MECHANICAL ROBUSTNESS**
Sung M. Kang, Andrew T. Bender, Karl F. Böhringer, Mohammad H. Malakooti, and Jonathan D. Posner
University of Washington, USA

- WP-18 EFFECT OF LOW FREQUENCY SIGNAL UP-CONVERSION ON FREQUENCY STABILITY IN CAPACITIVELY TRANSDUCED MICRORESONATORS**
James M.L. Miller¹, Nicholas E. Bousse², Hyun-Keun Kwon³, Gabrielle D. Vukasin⁴, Steven W. Shaw^{5,6}, and Thomas W. Kenny²
¹Trine University, USA, ²Stanford University, USA, ³Apple Incorporated, USA, ⁴Robert Bosch Research and Technology Center, USA, ⁵Florida Institute of Technology, USA, and ⁶Michigan State University, USA
- WP-19 FLEXIBLE ELECTROMAGNETIC ACTUATORS FOR WEARABLE HAPTIC DEVICES**
Naji Tarabay¹, Ananya Renuka Balakrishna², Tianshu Liu³, Priyanshu Agarwal³, and Camilo Velez¹
¹University of California, Irvine, USA, ²University of California, Santa Barbara, USA, and ³Meta Platforms Inc., USA
- WP-20 GENERALIZED MACHINE LEARNING METHOD TO EXTRACT FREQUENCY-COMPLIANCE COEFFICIENTS FROM MEMS RESONATOR MODEL**
Rahul Singaram Senthilkumar¹, Yinuo Enoch Zhao², and Xing Haw Marvin Tan³
¹St. Joseph Institution, SINGAPORE, ²Hwa Chong Institution, SINGAPORE, and ³Agency for Science, Technology and Research (A*STAR), SINGAPORE
- WP-21 IMPROVED PERFORMANCE OF PASSIVE LAYER-FREE CURVED PMUT ARRAY**
Chichen Huang¹, Shubham Khandare², Sri-Rajasekhar Kothapalli², and Srinivas Tadigadapa¹
¹Northeastern University, USA and ²Pennsylvania State University, USA,
- WP-22 MAGNETICALLY COUPLED RESONATORS FOR WIRELESS POWER TRANSMISSION TO INSECT SIZED FLAPPING WING ROBOTS**
Johannes M. James, Xingyi Shi, Joshua R. Smith, and Sawyer B. Fuller
University of Washington, USA
- WP-23 METHODOLOGY TO QUANTIFY CONTRIBUTION OF VARIOUS FEEDTHROUGH SOURCES IN EPI-SEALED DEVICES**
Disha Chugh¹, Hyun-Keun Kwon^{2,4}, Gabrielle D. Vukasin^{3,4}, and Saurabh A Chandorkar¹
¹Indian Institute of Science, Bangalore, INDIA, ²Centre Apple, USA, ³Robert Bosch Research and Technology Center, USA, and ⁴Stanford University, USA

- WP-24 NON-RESONANT VIBRATION ENERGY HARVESTER FOR SUB-HERTZ AND SUB-G VIBRATION**
Junyi Wang, Aobo Zhang, Diana Cantini, and Eun Sok Kim
University of Southern California, Los Angeles, USA
- WP-25 OPERATING FREQUENCY RANGES OF ULTRASOUND-BASED IMPLANTABLE GLUCOSE-SENSITIVE RESONATORS FOR IMPROVED SENSITIVITY AND LINEARITY**
Prattay Deepta Kairy, Simon Binder, Navid Farhoudi, Florian Solzbacher, and Christopher F. Reiche
University of Utah, USA
- WP-26 PROBING NONLINEARITY IN SUPERLATTICE HAFNIA-ZIRCONIA-ALUMINA NANO-ELECTROMECHANICAL RESONATORS**
S M Enamul Hoque Yousuf, Troy Tharpe, Roozbeh Tabrizian, and Philip X.-L. Feng
University of Florida, USA
- WP-27 SIMULTANEOUS DETECTION OF FLUID VISCOSITY AND DENSITY VIA PMUTS ASSISTED BY MACHINE LEARNING**
Pei-Chi (Peggy) Tsao¹, Megan Teng¹, Yande Peng¹, Vivek K. Premanadhan², Ting Chen³, Samantha Averitt¹, Wei Yue¹, Jong Ha Park¹, Huicong Deng³, Fan Xia¹, Yuan Gao¹, and Liwei Lin¹
¹*University of California, Berkeley, USA,*
²*Synergy Marine Group, SINGAPORE, and*
³*University of Chinese Academy of Sciences, CHINA*
- WP-28 THE REALIZATION AND TESTING OF A SAPPHIRE PRESSURE SENSOR MANUFACTURED BY LASER MICROMACHINING AND THERMOCOMPRESSIVE BONDING**
Austin L. Vera¹, David A. Mills², and Mark Sheplak¹
¹*University of Florida, USA and*
²*Interdisciplinary Consulting Corporation, USA,*
- WP-29 ULTRA-COMPACT, LOW-NOISE, AMPLITUDE-SENSITIVE AND PHASE-SENSITIVE INTEGRATED THIN-FILM GIANT MAGNETOIMPEDANCE SENSORS**
Bin Luo¹, Xianfeng Liang¹, Huaihao Chen¹, Cai Müller², Paul Raschdorf², Phillip Durdaut², Michael Höft², Jeffrey McCord², and Nian X. Sun¹
¹*Northeastern University, USA and* ²*Kiel University, GERMANY,*

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- WP-30 A 13.56 MHZ METAMATERIAL VIA THE INCORPORATION OF POLYIMIDE BASED FPCB AND NIZN FERRITE FOR WIRELESS POWER TRANSMISSION ENHANCEMENT**
Pin-Cheng Tseng, Mei-Syuan Wu, Wen-Hsiang Huang, Yu-Ting Cheng, Ming-Dou Ker, and Chung-Yu Wu
National Yang Ming Chiao Tung University, TAIWAN
- WP-31 A COMPACT ISOLATION FRAME FOR MITIGATING PACKAGING STRESS AND ANCHOR LOSS IN MICROACOUSTIC RESONATORS**
Maliha Sultana, Tanvir Hasan, Jennyfer Vivas Gomez, Kevin Chan, Hakhamanesh Mansoorzare, and Reza Abdolvand
University of Central Florida, USA
- WP-32 AN SOI-PCB WITH THERMOCOMPRESSION BONDED CMOS, MULTILAYER WIRING, AND NATIVE MEMS**
Yichen Liu, Daniel Lovell, and Kristofer S.J. Pister
University of California, Berkeley, USA
- WP-33 CONDUCTIVE DIRECT BONDING OF IN-SITU DOPED POLYSILICON FOR MEMS WAFER-LEVEL PACKAGING**
Vincent Pares¹, Amrid Amnache¹, Romain Stricher¹, Simon Landry², Paul Gond-Charton², Thierry Courcier¹, Serge Ecoffey¹, and Luc G. Fréchette¹
¹*Université de Sherbrooke, CANADA and*
²*Teledyne Dalsa Semiconducteur Inc. (TDSI), CANADA,*
- WP-35 INCREASE IN LONGIVITY OF IMPLANTABLE NEURAL DEVICE USING NOVEL MATERIAL**
Sandeep Negi^{1,2}, Christopher K. Nguyen³, David J. Warren², Stuart F. Cogan³, Florian Solzbacher², and Rajmohan Bhandari^{1,2}
¹*Blackrock Neurotech, USA,* ²*University of Utah, USA, and*
³*University of Texas at Dallas, Richardson, USA*
- WP-36 MONOLITHIC ELECTROWETTING PRISM FOR STRUCTURED ILLUMINATION MICROSCOPY**
Eduardo J. Miscalles¹, Catherine A. Saladrigas¹, Mo Zohrabi¹, Vikrant Kumar², Ioannis Kymissis², Juliet T. Gopinath¹, and Victor M. Bright¹
¹*University of Colorado Boulder, USA and*
²*Columbia University, USA*

- WP-37 SELF-ALIGNED SUB 15 NANOMETER NANOGAP AND NANOWIRE FORMATION ON SAPPHIRE**
Dean de Boer, Erwin Berenschot, and Niels Tas
University of Twente, NETHERLANDS
- WP-38 STRETCHABLE EUTECTOFIBERS VIA ROTARY WET-SPINNING FOR WEARABLE STRAIN SENSORS**
Danilo M. dos Santos¹, Jihyun Kim¹, Mario B. Wyrshch^{1,2}, Mathias Bonmarin^{1,2}, and Sameer Sonkusale¹
¹Tufts University, USA and ²Zurich University of Applied Sciences Technikumstrasse, SWITZERLAND,
- WP-39 TAILORED FOREST MICRONEEDLES USING CROSS OVER LINES LASER LITHOGRAPHY FOR SIMULTANEOUS DELIVERY OF MULTIPLE DRUGS**
Hasika Suresh, Danilo M. Dos Santos, Atul Sharma, Darian Myers, Sanjana Vissapragada, and Sameer Sonkusale
Tufts University, USA
- WP-40 TOWARDS A 3D PRINTED MICROFLUIDIC PIN-FIN COOLER USING TWO PHOTON POLYMERIZATION (TPP)**
Peter Sanchez, Ryan M. Price, and Robert C. Roberts
University of Texas, El Paso, USA
- WP-41 VARIABLE-SLOPE REFLECTIVE SURFACES FOR OPTICAL SYSTEM TESTING VIA NOVEL DIRECT LASER WRITING-BASED MICROREPLICATION**
Declan M. Fitzgerald^{1,2}, Ryan D. Sochol¹, and Anant Agrawal²
¹University of Maryland, USA and
²Food and Drug Administration, USA

Late News - Chemical or Biological Sensors, Actuators or Systems

- WP-42 GLUCOSE FACTOR IN THE TEST OF ISCHEMIA HEART DISEASE FOR DIABETIC PATIENTS USING MOLECULARLY IMPRINTED POLYMER /METHYLENE BLUE SENSING ELECTRODES**
Cheng-Yu Tsai¹, Yu-Ting Cheng¹, and Hsiao-En Tsai²
¹National Yang Ming Chiao Tung University, TAIWAN and
²National Taiwan University Hospital Hsin-Chu Branch, TAIWAN

- MP-43 MICRONEEDLE-INTEGRATED ELECTROCHEMICAL SENSOR TOWARD DETECTION OF BASOLATERAL SEROTONIN IN THE GI TRACT**
Sydney N. Overton, Joshua A. Levy, Michael A. Straker, Jinjing Han, and Reza Ghodssi
University of Maryland, USA

Late News - Physical Sensors, Actuators, or Systems

- WP-44 HIGH-QUALITY FACTOR, HIGH TCF SCANDIUM ALUMINUM NITRIDE MEMS RESONATOR FOR LOW-NOISE INFRARED SENSING**
Farah Ben Ayed, Aurelio Venditti, Pietro Simeoni, Zhenyun Qian, and Matteo Rinaldi
Northeastern University, USA
- WP-45 LOW-POWER THERMOMECHANICAL MODULE FOR TARGETED INGESTIBLE DEVICE BIOPSY**
Michael A. Straker, Joshua A. Levy, and Reza Ghodssi
University of Maryland, USA
- WP-46 TEMPERATURE-INSENSITIVE 2D RESONANT GAP-BASED STRAIN SENSOR**
Xintian Liu and Clark T.-C. Nguyen
University of California, Berkeley, USA

Late News - Technology, Materials, Packaging, and CAD

- WP-47 A SELF-AMPLIFIED SILICON-GERMANIUM NANOMECHANICAL RESONATOR WITH PIEZORESISTIVE HEAT ENGINES**
Faysal Hakim¹, Normarieli M. Passalacqua-Alvarado¹, Keshab R. Sapkota², Aleem Siddiqui², Xuebin Li³, Kevin S. Jones¹, George T. Wang², and Roozbeh Tabrizian¹
¹*University of Florida, USA*, ²*Sandia National Laboratories, USA*, and ³*Applied Materials, USA*
- WP-48 DIRECT VAN DER WAALS INTEGRATION OF 2D MATERIALS FOR HIGH-PERFORMANCE CHEMICAL SENSORS**
Peter F. Satterthwaite, Sarah O. Spector, Jaekang Song, and Farnaz Niroui
Massachusetts Institute of Technology, USA

- WP-49 MULTI-MATERIAL PALETTE FOR 3D MICROELECTRODE ARRAYS FOR A VARIETY OF 3D ELECTROGENIC MICROPHYSIOLOGICAL SYSTEMS**
Omar S. Cepeda Torres, Connor Edmonds,
Diana V. Rodríguez De Francisco, Edwin Davidson Barahona,
Charles Didier, and Swaminathan Rajaraman
University of Central Florida, USA
- WP-50 ULTRA-HIGH THERMAL CONVERSION EFFICIENCY IN A PROTOTYPE LIGHT SOURCE BASED ON PHONONIC MEMS STRUCTURE**
Sunghyun Hwang¹, James D. Overmeyer¹, S M Enamul Hoque Yousuf¹, William N. Carr², Philip X.-L. Feng¹, and Yong-Kyu Yoon¹
¹University of Florida, USA and ²Phononic MEMS Inc, USA

Poster Presentations - Session 3

Commercial and Open Posters

Wednesday, 5 June

18:30– 19:30

Commercial - Physical Sensors, Actuators, or Systems

- WCP-51 PIEZOELECTRIC MEMS-ACTUATORS BASED ON ALSC40%N AND PZT**
Yanfen Zhai^{1,2}, Andrea Bancora¹, Andrey Voloshin², Anat Siddharth², Sébastien Leni¹, and Tobias J. Kippenberg²
¹DeepLight SA, SWITZERLAND and ²Swiss Federal Institute of Technology Lausanne (EPFL), SWITZERLAND
- WCP-52 SENSIBLE SENSORS WITH UNINTERRUPTED OPERATION AND UNPRECEDENTED ACCURACY**
Zhenyun Qian, Matteo Rinaldi, Nabid Hossain, and Kritank Kalyan
Zepson Technologies Inc., USA

Commercial - Technology, Materials, Packaging, and CAD

- WCP-53 CUSTOMIZED MEMS SOLUTIONS FROM PROTOTYPE TO PRODUCTION VOLUMES**
Arne Leinse and Albert Prak
LioniX International, BV, NETHERLANDS
- WCP-54 DIE-TO-WAFER BONDING TECHNOLOGY FOR ADVANCED PACKAGING**
Viorel Dragoi, Mariana Pires, and Tobias Wernicke
EV Group E. Thallner GmbH, AUSTRIA

- WCP-55 HIGH-Q MEMS RESONATORS CHARACTERIZATION BY 4D DIGITAL HOLOGRAPHIC MICROSCOPE (DHM®)**
Frank Liu, François Mendels, Jean-Marc Collagrossi, Shenqi Xie, and Yves Emery
Lyncee Tec SA, SWITZERLAND
- WCP-56 JOIN THE IEEE MEMS TC!**
The IEEE MEMS Technical Community, USA
- WCP-57 MPO 100 - 3D LITHOGRAPHY SYSTEM FOR ADVANCING SENSORS AND ACTUATORS RESEARCH**
Yashica Brown, Benedikt Stender, and Willi Mantei
Heidelberg Instruments, USA
- WCP-58 THE COMPLETE DESIGN-TO-PRODUCTION SOLUTION FOR PZT MEMS**
Andrew O. Fung¹, Mario Kiuchi², Gen Matsuoka², Tsuyoshi Takemoto², and Alissa M. Fitzgerald¹
¹*A.M. Fitzgerald & Associates, LLC, USA and*
²*Sumitomo Precision Products Co., Ltd., JAPAN*
- WCP-59 BIOCOASTAL INSTITUTE FOR NANOSYSTEMS INNOVATION (NANOSI) LAUNCHES AT NORTHEASTERN UNIVERSITY**
Matteo Rinaldi and David Horsley
Northeastern University, USA

Open Posters

- WOP-01 A PCB BASED, LOW-COST, MEMS TACTILE DISPLAY FOR BRAILLE AND IMAGES**
Jonathan Bernstein¹, Maijie Xiang², and Robert White²
¹*Draper, USA and* ²*Tufts University, USA*
- WOP-02 ADVANCED MANUFACTURING LABORATORY AT THE UNIVERSITY OF MARYLAND**
Sydney N. Overton¹, Weijian Xian¹, Justin M. Stine¹, Jinjing Han¹, Kevin M. Daniels¹, and Reza Ghodssi¹
University of Maryland, USA
- WOP-03 BIOAERIUM : UBIQUITOUS MULTI-PATHOGEN SENSING FROM AIR USING NUCLEIC ACID AMPLIFICATION**
Nitin Jayakumar, Michael Caffrey, and Igor Paprotny
University of Illinois at Chicago, USA

- WOP-04 CAPSULE SYSTEM TOWARD REAL-TIME ELECTROCHEMICAL DETECTION OF HYDROGEN SULFIDE IN THE GI TRACT**
Justin M. Stine¹, Katie L. Ruland¹, Joshua A. Levy¹,
Luke A. Beardslee¹, Pankaj J. Pasricha², and Reza Ghodssi¹
¹University of Maryland, USA and ²Mayo Clinic Hospital, USA
- WOP-05 HIGH POWER MEMS OHMIC CONTACT FROM DC TO MILLIMETER WAVE**
Xu Zhu, Nicole D. Kerness, and Chris F. Keimel
Menlo Micro, USA
- WOP-06 MEMS MEETS MAGNONICS**
Sudhanshu Tiwari¹, Anuj Ashok¹, Connor James Devitt¹,
Wang Renyuan², and Sunil Bhawe¹
¹Purdue University, USA and ²BAE Systems, USA
- WOP-07 MICROSCALE PH GENERATION ON DEMAND: A PLATFORM FOR TUNING BIOMOLECULAR REACTIVITY**
Nadia Fomina, Christopher Johnson, Young Shik Shin,
Gabrielle Vukasin, and Christoph Lang
Robert Bosch Research and Technology Center, USA
- WOP-08 NANOFRAZOR TECHNOLOGY - FABRICATING ADVANCED 2D AND GRAYSCALE STRUCTURES USING THERMAL SCANNING PROBE LITHOGRAPHY AND DIRECT LASER SUBLIMATION**
Nicholas Hendricks, Julia Stark, Myriam Käppeli, Jana Chaaban,
and Emine Çağın
Heidelberg Instruments Nano AG, SWITZERLAND
- WOP-09 NANOSTRUCTURING GRAPHENE ON SILICON FOR ENHANCED SEMICONDUCTOR INTERCONNECTS**
Amani Salim, Adam Zahanuddin, Farihin Adzlan, Pretha Selvam,
and Iqbal Shamsul
nanoSkunkWorkX, MALAYSIA
- WOP-10 NEAR-ZERO STIFFNESS MEMS ACCELEROMETER WITH BUCKLING OF TUNABLE ELECTROTHERMAL MICROBEAMS**
Chen Wang¹, Hussein Hussein², Rui Amendoeira Esteves¹,
Hossein Fariborzi³, and Michael Kraft¹
*¹KU Leuven, BELGIUM, ²American University of Beirut, LEBANON,
and ³King Abdullah University of Science and Technology,
SAUDI ARABIA*
- WOP-11 NIH BRAIN BEHAVIOR QUANTIFICATION AND SYNCHRONIZATION SENSORS PROGRAM**
Yvonne Bennett
National Institute of Mental Health, USA

**WOP-12 QUADRUPLE MASS GYROSCOPE ANGLE RANDOM WALK
REDUCTION THROUGH LINEARIZED TRANSDUCTION**

Ryan Knight¹, Ryan Rudy¹, Jeffrey Pulskamp¹, Robert Benoit¹,
Don DeVoe², and Esmond Lau³

*¹DEVCOM Army Research Laboratory, USA, ²University of
Maryland, USA, and ³Oak Ridge Associated Universities, USA*

WOP-13 QUARTZ MEMS GYROSCOPES FOR INERTIAL NAVIGATION

Andrei M. Shkel, Austin R. Parrish, Eudald Sangenis,
Lois Meira Lopez, Crystal Wai, and Amin Ebrahimzadeh
University of California, Irvine, USA

**WOP-14 TOWARD MM-WAVE ACOUSTIC VIBRATION MEASUREMENTS
WITH PULSED LASER INTERFEROMETRY**

Marvin Schewe and Jason J. Gorman
NIST, USA



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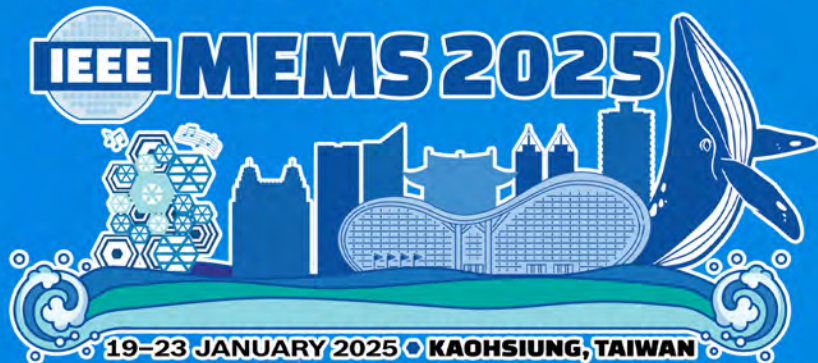
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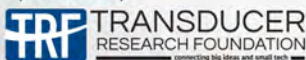
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