Preliminary Program

Sponsored by the

TRF TRANSDUCER RESEARCH FOUNDATION
connecting big ideas and small tech

Sunday, 2 June

10:00 - 15:00 **Workshop 1:** MEMS Know Howe

10:00 - 15:00 **Workshop 2:** Small-Scale Robots: From One to a Swarm

10:00 - 12:00 **Workshop 3:** Improving Benchtop to Clinic Translation in Transducers Research

13:00 - 15:00 **Workshop 4:** Beyond Technical Expertise: Dealing with Sources of Personal and Professional Stress

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

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

08:15 **IoT4Ag SENSORS AND SYSTEMS FOR PRECISION AGRICULTURE**
Cherie R. Kagan
University of Pennsylvania, USA

Session 1: Microsystems for Biosensing

08:55 **INGESTIBLE DEVICE FOR NOISE-RESILIENT BIOIMPEDANCE MONITORING IN GASTROINTESTINAL TRACT**
Brian M. Holt[1], Justin M. Stine[1], Luke A. Beardslee[1], Pankaj J. Pasricha[2], and Reza Ghodssi[1]
[1]University of Maryland, USA and [2]Mayo 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 **SMART TRACEABLE ELECTRONIC-FREE CAPSULE FOR GASTROINTESTINAL MICROBIOME MONITORING**
Sina Nejati, Devendra Sarnaik, 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

10:45 **FORTY YEARS OF MEMS INNOVATION AT HILTON HEAD WORKSHOP: FROM EMERGING TECHNOLOGIES TO COMMERCIAL PRODUCTS**
Alissa M. Fitzgerald
AMFitzgerald, USA

Session 2: Industrial, Higher TRL Microsystems

11:15 **CARDIOPULMONARY AUSCULTATION SYSTEM ENABLED BY A NOVEL BEYOND-RESONANCE SENSING ACCELEROMETER**
Tzeno Galchev[1], Longwei Xiao[2], Wenyong Zhang[2], Haozhe Dong[2], Jianglong Zhang[1], James Lin[1], Zhengxin Zhao[1], Adam Spirer[1], Jin Peng[3], Hua Jian[4], Khiem Nguyen[1], and Sam Zhang[1]
[1]Analog Devices Inc., USA, [2]Catron Inc., USA, [3]Sichuan University, CHINA, and [4]Sichuan Provincial People's Hospital, CHINA,

11:35 **A MEMS-BASED ANALOG COMPUTER FOR EDGE AI COMPUTING**
David Lin[1], Johan Reimann[1], Dorin Calbaza[1], Robert MacDonald[1], Zhihui Yang[1], Abdallah Al Zubi[2], Mohammad Megdadi[2], and Fadi AlSaleem[2]
[1]GE Aerospace Research, USA and
[2]University of Nebraska-Lincoln, USA,

11:55 **NESTED-MEMS TEMPERATURE COMPENSATED SINGLE-CRYSTALLINE SILICON OSCILLATOR**
Amir Rahafrooz, Diego E. Serrano, Ryan Hennessy, William McDonald, Duane Younkin, Kieran Nunan, Stanley Che, and Ijaz Jafri
Panasonic Massachusetts Laboratory, USA

12:15 **Poster Preview – Session 1**

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

Poster Session 1

14:15 **Contributed and Late News**
See page 12 for listing of poster presentations

16:45 pm **End of Day**

Tuesday, 4 June

07:30 **Breakfast**

08:00 **Announcements**

Plenary Speaker II

08:05 **HYBRID LOW LOSS INTEGRATED PHOTONICS: FROM CHIPSCALE FREQUENCY COMBS, FREQUENCY AGILE LASERS, ERBIUM AMPLIFIERS TO CRYOGENIC QUANTUM INTERCONNECTS**
Tobias Kippenberg
Swiss Federal Institute of Technology Lausanne (EPFL), SWITZERLAND

Session 3: Resonators, Oscillators and Micromotors

08:45 **Q-FACTOR ENHANCEMENT OF PIEZO-ON-SILICON MEMS RESONATORS THROUGH MODE-COUPLING AND TOPOLOGICAL TANK CONFIGURATIONS**
Suaid Tariq Balghari, Abid Ali, and Frederic Nabki
Ecole de Technologie Superieure, CANADA

09:05 **ULTRA-STABLE MEMS OSCILLATOR WITH 42 PPT FRACTIONAL FREQUENCY STABILITY AT 85 SECONDS**
Jintark Kim[1], Rakibul Islam[1], Jiheng Jing[1], Jie Yan[1], Juneau Larson[1], Gabrielle Vukasin[2], Ryan Kwon[2], Saurabh Saxena[1,3], Thomas W. Kenny[2], Pavan K. Hanumolu[1], and Gaurav Bahl[1]
[1]University of Illinois, Urbana-Champaign, USA, [2]Stanford University, USA, and [3]Indian 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[1,2], Yichen Liu[1,2], Liwei Lin[1,2], and Kristofer S. J. Pister[1,2]
[1]University of California, Berkeley, USA and [2]Berkeley Sensor & Actuator Center, USA,

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

10:24 am **Denice Denton Mentorship Award Announcement**

Invited Speaker II

10:15 **CHANGING THE COURSE OF HEART FAILURE DISEASE MANAGEMENT USING MEMS - A CardioMEMS STORY**
Michael Fonseca
StethX, USA

Session 4: Chemical and Environmental Sensing

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 Hao[1], Yue Zheng[1], Ethan W. Schaler[2], and Azadeh Ansari[1]
[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 and Seokheun Choi
State University of New York, Binghamton, USA

11:45 **Hilton Head Education, History, and Conservation Talk**
Jan McKelvey
Lean Ensemble Theater, USA

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

14:00 - 16:00 **MSIG Industry Session**

14:00 - 19:00 **Recreational Activities** (on your own)

18:00 - 19:00 **Graduate Student Networking Event**

19:00 - 22:00 **Banquet**

Wednesday, 5 June

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

7:30 am **Breakfast**

8:10 am **Announcements**

Plenary Speaker III

08:15

Christopher J. Cannova
Aligned Orthopedic Partners, USA

Session 5: Medical MEMS

08:55 **AN APPROACH FOR 3D MICROPRINTING OF SOFT ROBOTIC BIOPSY TOOL AT 1 FRENCH LENGTH SCALE VIA EX SITU DIRECT LASER WRITING**
Sunandita Sarker, Declan Fitzgerald, Olivia M. Young, Bailey M. Felix, and Ryan D. Sochol
University of Maryland, 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. Derin[1], Abhiram Pulavarthi[1], Jordan Edmunds[2], Jack Guida[1], Siddartha Ghosh[1], and Soner Sonmezoglu[1]
[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 Kim[2], Adeoye Olomodosi[2], Nicholas Au Yong[1,2], Brooks Lindsey[1,2], and David R. Myers[1,2]
[1]Emory University, USA and [2]Georgia Institute of Technology, USA,

10:15 **Break and Tabletop Inspection**

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

Invited Speaker III

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

Session 6: Novel Devices - I

11:15 **POSS-ENABLED MECHANICAL ENHANCEMENT FOR 3D-NANOPRINTED HIGH-ASPECT-RATIO MICROINJECTION NEEDLES**
Adira Colton[1], Sunandita Sarker[1], A. Muhaymin Chowdhury[1], Prableen Chowdhary[2], Joshua A. Levy[1], Katie L. Ruland[1], Reza Ghodssi[1], Rachel Brewster[2], Kinneret Rand-Yadin[3], and Ryan D. Sochol[1]
[1]University of Maryland, College Park, USA, [2]University of Maryland, Baltimore County, USA, and [3]SeeTrue Technology, 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 Luo[1], Xianfeng Liang[1], Huaihao Chen[1], Neville Sun[1], Hwaider Lin[2], and Nian-Xiang Sun[1]
[1]Northeastern University, USA and
[2]Winchester Technologies LLC, USA,

12:15 **Poster Preview – Session 2**

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

Poster Session 2

14:30 **Contributed and Late News**
See page 19 for listing of poster presentations

17:00 - **Free Time**

Poster Session 3 and Reception

18:30 **Commercial and Open Posters**

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

Thursday, 6 June

07:30 **Breakfast**

08:10 m **Announcements**

Plenary Speaker IV

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

Session 7: Novel Devices - II

08:55 **SIO2/TI/PT HOT WIRE FILAMENT FOR HIGH SPEEDS AND ITS IMPLEMENTATION IN MECHANICAL VENTILATORS AS MICRO ANEMOMETER**
Iker R. Chavez-Urbiola, Juan Ponce-Hernandez, Pablo Tirado-Cantu, Jesus J. Alcantar-Peña, and Daniela Diaz-Alonso
Center for Engineering and Industrial Development (CIDESI), MEXICO

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 Sok Kim
University of Southern California, 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: Dr. Ginel Hill

10:25 **DECADES OF MEMS TIMING**
Ginel Hill
SiTime, USA

Session 8: Late News

To Be Determined

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)63+/2+ ELECTRODE WITH SU-8 MICROPILLARS FOR REAL-TIME HYDROGEN SULFIDE MONITORING IN LIQUIDS**
Chih-Hsiang Su[1], Mu-Yi Fang[1], Ting-Wei Huang[1], Yu-Ting Cheng[1], Hsiao-En Tsai[2], and Yih-Shurng Chen[2]
[1]National Yang Ming Chiao Tung University, TAIWAN and [2]National 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 SYSTEM: PH-GUIDED WOUND MONITORING AND PRECISION DRUG DELIVERY USING FLEXIBLE ELECTRONIC TECHNOLOGY**
Akshay Krishnakumar[1,2], Muhammad Masud Rana[1,2], Sarath Gopalakrishnan[1,2], Jose Waimin[1,2], and Rahim Rahimi[1,2]
[1]Brick Nanotechnology Center, USA and [2]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 Z. 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-COALESCING STICKER MICROFLUIDIC FOR ENHANCED MANAGEMENT OF CARBAPENEMASE-PRODUCING ORGANISMS IN HEALTHCARE SETTINGS**
Anjana Dissanayaka[1,2], Ali Haider[1], Lily Kamat[1,2], Priscilla Delgado[1,2], Jesse J. Waggoner[1], and David R. Myers[1,2]
[1]Emory University, USA and [2]Georgia Institute of Technology, USA,

MP-10 **SERS-ENHANCED OPTICAL FIBER BIOSENSORS FOR ULTRASENSITIVE SALMONELLA DIAGNOSTICS**
Mai Abuhelwa[1], Arshdeep Singh[1], Jiayu Liu[1], Morey Amit[2], Lakshmikantha H. Channaiah[1], and Mahmoud Almasri[1]
[1]University of Missouri, Columbia, USA and
[2]Auburn University, USA,

MP-11 **ULTRA THIN SMART ELECTROPALATOGRAPHY SYSTEM TO ASSIST LINGUISTIC AND MEDICAL DIAGNOSIS**
Ziqi Jia, Sunghyun Hwang, Saeyeong Jeon, and Ariel David Cerpa
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[1], Jack Kramer[1], Tzu-Hsuan Hsu[2], Omar Barrera[1], Ian Anderson[1], Sinwoo Cho[1], and Joshua Campbell[1]
[1]University of Texas, Austin, USA and
[2]National Tsing Hua University, TAIWAN,

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. Hussein, Farah Ben Ayed, Aurelio Venditti, Pietro Simeoni, Cristian Cassella, and Matteo Rinaldi
Northeastern University, USA

MP-15 **AI-DRIVEN SCANNING GHZ ULTRASONIC IMAGING BASED MEMS METROLOGY**
Karan Jha[1], Anuj Baskota[1], Justin Kuo[1], Serhan Ardanuç[1], Scott Zimmerman[1], and Amit Lal[1,2]
[1]Geegah Inc, USA and [2]Cornell 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 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 LEVITATION ACTUATOR**
Mohammad Alzgool, 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 R. Phelps and Reza Abdolvand
University of Central Florida, USA

MP-24 **MID-AIR PARTICLE MANIPULATIONS BY A 2X2 PMUT ARRAY**
Wei Yue[1], Megan Teng[1], Yande Peng[1], Fan Xia[1], Peggy Tsao[1], Yuan Gao[1], Shinsuke Ikeuchi[2], Yasuhiro Aida[2], Seiji Umezawa[2], and Liwei Lin[1]
[1]University of California, Berkeley, USA and [2]Murata Manufacturing Co., Ltd., JAPAN,

MP-25 **NONLINEAR INTERNAL RESONANCE FOR GAS SENSING**
Wagner B. Lenz[1], Rodrigo T. Rocha[1,2], Fahimullah Khan[1,3], Carlos A. Grande[1], 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 Yan[1], Jintark Kim[1], Rakibul Islam[1], Jiheng Jing[1], Dongsuk D. Shin[2], Saurabh Saxena[1,3], Pavan K. Hanumolu[1], Thomas W. Kenny[2], and Gaurav Bahl[1]
[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. Rodrigues[1], Clifford F. Frez[1], Savannah R. Eisner[2,3], Debbie G. Senesky[2], and Mina Rais-Zadeh[1]
[1]California Institute of Technology, USA, [2]Stanford University, USA, and [3]Columbia University, USA

MP-29 **TRAMPOLINE Si_3N_4 MAGNETOMETERS WITH 330 PT/$\sqrt{Hz}$ 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 **A 3D PRINTED MICRO LIQUID THERMAL REGULATOR (MLTR) FOR IN-VIVO CHRONIC PAIN APPLICATIONS**
Jazune Madas, Andre Childs, Lei Zhai, Zixi Cheng, and Swaminathan Rajaraman
University of Central Florida, USA

MP-32 **ADVANCING MILLIMETER-WAVE TECHNOLOGIES: HIGH-EFFICIENCY 3D AIR-LIFTED INDUCTORS MADE OF A HIGHLY MANUFACTURABLE CU/CO METACONDUCTOR**
Saeyeong Jeon, Alexander Wilcher, Ariel David Cerpa, 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 Lohani[2], Ryan M. Price[1], Peter Sanchez[1], and Robert C. Roberts[1]
[1]University of Texas, El Paso, USA and [2]Pennyslvania State University, USA,

MP-34 **ENABLING CUT-RESISTANT SUPERHYDROPHOBIC SURFACES USING A HIGHLY ENTANGLED SOFT POLYMERIC SUBSTRATE**
Junce Cheng and Tingyi 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 and Ponnambalam Ravi Selvaganapathy
McMaster University, CANADA

MP-39 **SUPERHARMONIC RESONANT RESPONSE MEASUREMENT (SRRM): A NEW METHOD FOR MEASURING SPONTANEOUS POLARIZATION**
Vishnu Kumar[1], Shreeraj Joshi[1], Sudhanshu Tiwari[1,2], Upanya Khandelwal[1], Rudra Pratap[1,3], Pavan Nukala[1], and Saurabh Chandorkar[1]
[1]Indian Institute of Science, Bengaluru, INDIA, [2]Purdue University, USA, and [3]Plaksha University, INDIA

MP-40 **TAILORING ENHANCEMENT OF SILICON-DI-OXIDE ADHESION TO POLYCARBONATE SUBSTRATES FOR 3D MICROELECTRODE ARRAYS (3D MEAS) AND OTHER BIOSENSORS**
Surbhi Tidke, Omar S. Cepeda-Torres, Brian E. Butkus, Andre Childs, and Swaminathan Rajaraman
Universicty of Central Florida, USA

MP-41 **TRANSFERRING SOFT DOUBLY RE-ENTRANT MICROSTRUCTURES FOR MECHANICALLY RESILIENT OMNIPHOBIC SURFACES**
Qingyang Sun and Tingyi L. Liu
University of Massachusetts, Amherst, USA

MP-42 **VERTICALLY ALIGNED CARBON NANOTUBES FOR VIRUS CAPTURE AND DETECTION**

Yin-Ting Yeh and Mauricio Terrones
Pennsylvania State University, USA

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. Wawrzynek[1], John Z. Zhang[1], Ioannis Kymissis[2], Elizabeth S. Olson[2], Hideki Heidi Nakajima[3,4], and Jeffrey H. Lang[1]
[1]Massachusetts Institute of Technology, USA, [2]Columbia University, USA, [3]Harvard University, USA, and [4]Mass Eye and Ear, USA,

WP-02 **AUTONOMOUS MICROFLUIDIC DEVICE FOR THE NAKED-EYE DETECTION OF BENZODIAZEPINES IN ADULTERATED BEVERAGES**
Isabel Poves-Ruiz, Enrique Azuaje-Hualde, Igor Corchado-Gonzalez, Lourdes Basabe-Desmonts, and Fernando Benito-Lopez
University of the Basque Country, 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 TUNABLE SUBMICRON 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, 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 Chang, Guntis Rutins, Omar Cepeda Torres, Saqib Shahzad, Swaminathan Rajaraman, and Laurene Tetard
University of Central Florida, USA

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 DIAGNOSTICS FOR ORAL HEALTH USING SURFACE ENHANCED RAMAN DETECTION IN LATERAL FLOW ASSAYS**
Daewoo Han, Lyndsay Kissell, Der Vang, Pietro Strobbia, and Andrew Steckl
University of Cincinnati, USA

WP-09 **SCALABLE ELECTROPOLYMERIZATION OF VERTICAL GRAPHENE OXIDE ELECTRODES AS A PHYSICAL/CHEMICAL BIOSENSOR PLATFORM**
Amani Salim[1], Farihin Adzlan[1], Haris Lotfi[1], Iman Ismail[1], Adam Zahanuddin[1], Sazwin Ishak[1], Malini Kanapathy[1], Pretha Selvam[1], Iqbal Shamsul[1], and D. Marshall Porterfield[2]
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WP-10 **TRI-COMPARTMENT CHIP WITH MICROELECTRODE ARRAY AND DR1-GLASS GROOVES FOR NEURONAL CELL ALIGNMENT**
Tomi Ryynänen, Chiara Fedele, Anna-Mari Moilanen, Jorma Vihinen, Lassi Sukki, Kaisa Tornberg, Saara Haikka, Susanna Narkilahti, Arri Priimägi, and Pasi Kallio
Tampere University, FINLAND

WP-11 **VERTICAL MICRO-NANOCHANNEL INTEGRATION FOR RELATIVE SURFACE PROTEIN ABUNDANCE QUANTIFICATION ON LIPOSARCOMA EXTRACELLULAR VESICLES**
Premanshu Kumar Singh, Ali Fahad Usmani, Patricia Sarchet, Raphael Pollock, and Shaurya Prakash
Ohio State University, USA

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WP-12 **2-SNESAT: SCALABLE BEHAVIOR-DIFFERENTIATED CONTROL FOR SWARMS OF PROGRAMMABLE MEMS MICROROBOTS**
Ratul Majumdar Majumdar, Milos Zefran, and Igor Paprotny
University of Illinois, Chicago, USA

WP-13 **A METHOD TO EXTRACT AND MODEL STRUCTURAL ASYMMETRIES IN DUAL-SHELL RESONATOR 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 Alzgool[1], Yu Tian[1], Benyamin Davaji[2], and Shahrzad Towfighian[1]
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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 Islam[1], Amrid Amnache[1], Richard Beaudry[2], Maurice Delafosse[2], Serge Ecoffey[1], and Luc G. Fréchette[1]
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WP-17 **DESIGN AND FABRICATION OF LIQUID METAL TACTILE SENSORS WITH ENHANCED SENSITIVITY AND MECHANICAL ROBUSTNESS**

Sung M. Kang, Karl F. Böhringer, Mohammad H. Malakooti, and Jonathan D. Posner
University of Washington, USA

WP-18 **EFFECTS OF LOW FREQUENCY SIGNAL UP-CONVERSION ON FREQUENCY STABILITY IN CAPACITIVELY TRANSDUCED MICRORESONATORS**

James ML. Miller[1], Nicholas E. Bousse[2], Hyun-Keun Kwon[3], Gabrielle D. Vukasin[4], Steven W. Shaw[5], and Thomas W. Kenny[2]
[1]Trine University, USA, [2]Stanford University, USA, [3]Apple Inc., USA, [4]Robert Bosch Research and Technology Center, USA, and [5]Florida Institute of Technology

WP-19 **FLEXIBLE ELECTROMAGNETIC ACTUATORS FOR WEARABLE HAPTIC DEVICES**

Naji Tarabay[1], Ananya Renuka Balakrishna[2], Tianshu Liu[3], Priyanshu Agarwal[3], and Camilo Velez[1]
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WP-20 **GENERALIZED MACHINE LEARNING METHOD TO EXTRACT FREQUENCY-COMPLIANCE COEFFICIENTS FROM MEMS RESONATOR MODEL**

Rahul Singaram Senthilkumar[1], Yinuo Enoch Zhao[2], and Xing Haw Marvin Tan[3]
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WP-21 **IMPROVED PERFORMANCE OF PASSIVE LAYER-FREE CURVED PMUT ARRAY**

Chichen Huang[1], Shubham P. Khandare[2], Sri-Rajasekhar Kothapalli[2], and Srinivas Tadigadapa[1]
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[2]Pennsylvania 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 Chugh
Indian Institute of Science, Bangalore, INDIA

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, 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 NANOELECTROMECHANICAL 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 Tsao[1], Megan Teng[1], Yande Peng[1], Vivek K. Premanadhan[2], Ting Chen[3], Samantha Averrit[1], Wei Yue[1], Jong Ha Park[1], Huicong Deng[4], Fan Xia[1], Yuan Gao[1], and Liwei Lin[1]
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WP-28 **THE REALIZATION AND TESTING OF A SAPPHIRE PRESSURE SENSOR MANUFACTURED BY LASER MICROMACHINING AND THERMOCOMPRESSION BONDING**
Austin L. Vera[1], David A. Mills[2], and Mark Sheplak[1]
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WP-29 **ULTRA-COMPACT, LOW-NOISE, AMPLITUDE-SENSITIVE AND PHASE-SENSITIVE INTEGRATED THIN-FILM GIANT MAGNETOIMPEDANCE SENSORS**
Bin Luo[1], Xianfeng Liang[1], Huaihao Chen[1], Cai Müller[2], Paul Raschdorf[2], Phillip Durdaut[2], Michael Höft[2], Jeffrey McCord[2], and Nian-Xiang Sun[1]
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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 Pister
University of California, Berkeley, USA

WP-33 **CONDUCTIVE DIRECT BONDING OF IN-SITU DOPED POLYSILICON FOR MEMS WAFER-LEVEL PACKAGING**

Vincent Pares[1], Amrid Amnache[1], Romain Stricher[1], Simon Landry[2], Paul Gond-Charton[2], Thierry Courcier[1], Serge Ecoffey[1], and Luc G. Fréchette[1]
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WP-34 **FABRICATION OF SUPERHYDROPHOBIC STRUCTURES VIA AEROSOL JET PRINTING**

Jace Rozsa[1], Ke Zhong[1], Dinesh Patel[1], Lining Yao[2], Mohammad Islam[1], and Gary K. Fedder[1]
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[2]University of California, Berkeley, USA,

WP-35 **INCREASE IN LONGIVITY OF IMPLANTABLE NEURAL DEVICE USING NOVEL MATERIAL**

Sandeep Negi[1,2] and Rajmohan Bhandari[1,2]
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WP-36 **MONOLITHIC ELECTROWETTING PRISM FOR STRUCTURED ILLUMINATION MICROSCOPY**

Eduardo J. Miscles[1], Catherine A. Saladrigas[1], Mo Zohrabi[1], Vikrant Kumar[2], Ioannis Kymissis[2], Juliet T. Gopinath[1], and Victor M. Bright[1]
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WP-37 **SELF-ALIGNED SUB 15 NANOMETER NANOGAP AND NANOWIRE FORMATION ON SAPPHIRE**

Dean de Boer, Erwin Berenschot, and Niels Tas
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WP-38 **STRETCHABLE EUTECTOFIBERS VIA ROTARY WET-SPINNING FOR WEARABLE STRAIN SENSORS**

Danilo M. dos Santos[1], Jihyun Kim[1], Mario Wyrsch[2], Mathias Bonmarin[2], and Sameer Sonkusale[1]
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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**

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