PRELIMINARY PROGRAM

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The Executive Committee reserves the right to amend the program if necessary
Sunday, June 3

6:00 pm - Registration and Welcome Reception
9:00 pm

Monday, June 4

7:00 am  Breakfast
7:45 am  Welcome
TRF President - Thomas W. Kenny, Stanford University, USA
TRF Director - Leland “Chip” Spangler, Aspen Microsystems, USA
Workshop Chair - Tina Lamers, Uber ATG, USA
Program Chair - Mina Rais-Zadeh, University of Michigan, USA

Plenary Presentation I
Session Chair: M. Rais-Zadeh, University of Michigan, USA

8:15 am  ENABLING THE NEXT GENERATION OF MEMS TECHNOLOGY
William Chappell¹, R.H. Olsson III¹, and R.G. Polcawich¹,²
¹DARPA, USA and ²US Army Research Laboratory, USA

Session 1 - Physics of Microfluidics
Session Chair: C. Buie, Massachusetts Institute of Technology, USA

9:05 am  PROBING THE FUNDAMENTAL EVAPORATION LIMIT WITH A NANOPOROUS MEMBRANE DEVICE
Z. Lu¹, K.L. Wilke¹, I. Kinefuchi², and E.N. Wang¹
¹Massachusetts Institute of Technology, USA and ²University of Tokyo, JAPAN

9:25 am  A MICROFLUIDIC DEVICE FOR MECHANICAL PROFILING OF HYDROGEL MICROPARTICLES
Y. Niu and Y. Zhao
Ohio State University, USA

9:45 am  DROPLET MANIPULATION ON A SURFACE WITH ANISOTROPIC WETTABILITY USING IN-PLANE SYMMETRIC CYCLIC VIBRATION
L. Qi, C. Ruck, and Y. Zhao
Ohio State University, USA

10:05 am  Break and Table Top Exhibits
Session 2 - Optical Microsystems
Session Chair: J. Gorman, National Institute of Standards & Technology, USA

10:30 am  TUNABLE COLOR REFLECTOR WITH ZERO STATIC POWER
M. Jafari¹, L.J. Guo¹, and M. Rais-Zadeh¹,²
¹University of Michigan, USA and
²NASA Jet Propulsion Laboratory (JPL), USA

10:50 am  A RECONFIGURABLE OPTOFUIDIC DEVICE FOR ADAPTIVE IMAGING AND POSITION ESTIMATION WITH A WIDE FIELD OF VIEW
H. Huang and Y. Zhao
Ohio State University, USA

11:10 am  BIOINSPIRED MULTIFUNCTIONAL NANOSTRUCTURES FOR MICRO-OPTICAL IMPLANTS
V. Narasimhan¹, R.H. Siddique¹, J.O. Lee¹, S. Kumar¹, B. Ndjamen¹, J. Du², N. Hong¹, D. Sretavan², and H. Choo¹
¹California Institute of Technology, USA and
²University of California, San Francisco, USA

11:30 am  Preview of Poster Session 1 Presentations
Session Chairs: E. Briot, Qorvo, USA and J. Chan, ECS Federal, LLC, USA

12:00 pm  Networking Lunch

Poster Session 1
Session Chair: D. Weinstein, Purdue University, USA

1:30 pm  Contributed and Late News
See page 32 for listing of poster presentations

4:00 pm  End of Day
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Tuesday, June 5

7:00 am  Breakfast

7:10 am - 7:45 am  GUIDANCE TO ACHIEVING SUCCESS WITH NSF PROPOSALS: A PROGRAM DIRECTOR’S VIEW
Shubhra Gangopadhyay
National Science Foundation (NSF), USA

8:10 am  Announcements

Plenary Presentation II
Session Chair: A. Herr, University of California, Berkeley, USA

8:15 am  TOWARDS INDUSTRIALISATION OF MICROFLUIDIC SAMPLE-TO-ANSWER SOLUTIONS ENABLING POINT-OF-USE TESTING OF BIOSAMPLES: A DESIGN-FOR-MANUFACTURE LED PLATFORM APPROACH
Jens Ducrée
Dublin City University, IRELAND

Session 3 - Wearable Devices
Session Chair: Y.-K. Yoon, University of Florida, USA

9:05 am  PRECISION HIGH-BANDWIDTH OUT-OF-PLANE ACCELEROMETER AS CONTACT MICROPHONE FOR BODY-WORN AUSCULTATION DEVICES
P. Gupta, Y. Jeong, J. Choi, M. Faingold, A. Daruwalla, and F. Ayazi
Georgia Institute of Technology, USA

9:25 am  MICROFABRICATED ELECTRODYNAMIC WIRELESS POWER RECEIVER FOR BIO-IMPLANTS AND WEARABLES
N. Garraud, D. Alabi, J.D. Varela, D.P. Arnold, and A. Garraud
University of Florida, USA

9:45 am  A WIRELESSLY CONTROLLED FULLY IMPLANTABLE MICROSYSTEM FOR NANO-LITER RESOLUTION INNER EAR DRUG DELIVERY
F. Forouzandeh¹, A. Alfadhel¹, X. Zhu², J.P. Walton², D.R. Cormier¹, R.D. Frisina², and D.A. Borkholder¹
¹Rochester Institute of Technology, USA and ²University of South Florida, USA

10:05 am  Break and Table Top Exhibits
Session 4 - Microsystems for Biological Applications
Session Chair: M. Ziaei, iSono Health, USA

10:30 am  MULTISCALE LIQUID METAL THIN-FILM PATTERNING BASED ON SOFT LITHOGRAPHY FOR SKIN-MOUNTABLE, SOFT AND 3D-INTEGRATED BIOLOGICAL MICROSYSTEMS
M. Kim, C. Kim, H. Alrowais, P. Getz, and O. Brand
Georgia Institute of Technology, USA

10:50 am  ROBUST AND SCALABLE TISSUE-ENGINEERED ELECTRONIC NERVE INTERFACES (TEENI)
University of Florida, USA

11:10 am  One Man’s Purpose – A Radio Play

12:15 pm - Networking Lunch
1:45 pm

7:00 pm - Tuesday Banquet
10:00 pm
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Wednesday, June 6

7:15 am  **Breakfast**

7:15 am  **Women In MEMS**

8:10 am  **Announcements**

**Plenary Presentation III**
Session Chair: F. Ayazi, Georgia Institute of Technology, USA

8:15 am  **WIRELESS INTEGRATED MICRO SYSTEMS (WIMS): PAST, PRESENT, FUTURE**
Khalil Najafi
*University of Michigan, USA*

**Session 5 - Levitated, Flying & Running Microrobots**
Session Chair: S. Bergbreiter, University of Maryland, USA

9:05 am  **A SIX-LEGGED MEMS SILICON ROBOT USING MULTICHIP ASSEMBLY**
D.S. Contreras and K.S.J. Pister
*University of California, Berkeley, USA*

9:25 am  **A 3D-PRINTED 1 MG LEGGED MICROROBOT RUNNING AT 15 BODY LENGTHS PER SECOND**
R. St. Pierre¹, W. Gosrich², and S. Bergbreiter¹
¹*University of Maryland, USA*  
²*State University of New York, Buffalo, USA*

9:45 am  **BATCH-FABRICATION OF DIAMAGNETICALLY LEVITATED MICROROBOTS**
C. Velez¹, R.E. Pelrine², A. Wong-Foy², and D.P. Arnold¹
¹*University of Florida, USA*  
²*SRI International, USA*

10:05 am  **TAKEOFF OF A FLYING MICROROBOT WITH COTS SENSOR PAYLOAD USING ELECTROHYDRODYNAMIC THRUST PRODUCED BY SUB-MILLIMETER CORONA DISCHARGE**
D.S. Drew and K.S.J. Pister
*University of California, Berkeley, USA*

10:25 am  **Break and Table Top Exhibits**
**Session 6 - Micro-Resonators & Resonator-Based Frequency Combs**
Session Chair: A. Duwel, Charles Stark Draper Laboratory, Inc., USA

10:50 am  **A FERROELECTRIC CAPACITOR (FECAP) BASED UNRELEASED RESONATOR**  
Y. He¹, B. Bahr², and D. Weinstein¹  
¹Purdue University, USA and ²Texas Instruments, USA

11:10 am  **PIEZOELECTRIC SINGLE CRYSTAL 6H SILICON CARBIDE MICROELECTROMECHANICAL RESONATORS**  
R. Perahia, L.D. Sorenson, J.L. Bregman, L.X. Huang,  
M.S. White, K.S. Holabird, and D.T. Chang  
HRL Laboratories, LLC, USA

11:30 am  **FREQUENCY COMB GENERATION IN A NONLINEAR RESONATOR THROUGH MODE COUPLING USING A SINGLE TONE DRIVING SIGNAL**  
D.A. Czaplewski¹, S.W. Shaw², O. Shoshani³, M.I. Dykman⁴,  
and D. Lopez¹  
¹Argonne National Laboratory, USA, ²Florida Institute of Technology, USA, ³Ben-Gurion University of the Negev, ISRAEL, and ⁴Michigan State University, USA

11:50 am  **ULTRA-HIGH Q MONOCRYSTALLINE SILICON CARBIDE DISK RESONATORS ANCHORED UPON A PHONONIC CRYSTAL**  
J. Yang, B. Hamelin, S.-D. Ko, and F. Ayazi  
Georgia Institute of Technology, USA

12:10 pm - **Poster Preview of Poster Session 2 Presentations**  
Session Chairs: A. Lal, Cornell University, USA and M.A. Maher, SoftMEMS, USA

12:40 pm - **Networking Lunch**
**Poster Session 2**  
Session Chair: M. Motiee, Apple, Inc., USA

2:10 pm - **Contributed and Late News**  
4:40 pm  See page 38 for listing of poster presentations

**Poster Session 3**  
Session Chair: Q. Zou, Avago Technologies, USA

6:30 pm - **Commercial and Open Posters**  
See page 44 for listing of poster presentations

8:00 pm - **Awards Ceremony**

8:15 pm **RUMP Session**  
10:00 pm
Microsystems & Nanoengineering

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Thursday, June 7

7:30 am  Breakfast

8:10 am  Announcements

**Plenary Presentation IV**
Session Chair: T. Lamers, Uber ATG, USA

8:15 am  **TOWARDS INTEGRATED OPTICAL GYROS USING BRILLOUIN LASERS**
Kerry Vahala, Y.H. Lai, M.G. Suh, J. Li, and K.Y. Yang
*California Institute of Technology, USA*

**Session 7 - Late News Frequency-References, -Combs, and -Shifting Sensors**
Session Chair: R. Perahia, HRL Laboratories, USA

9:05 am  **A NEW LOW POWER MEMS DUAL MODE CLOCK WITH PPB STABILITY OVER TEMPERATURE**
L. Comenencia Ortiz¹, H.-K. Kwon¹, J. Rodriguez¹, D.B. Heinz¹, Y. Chen², G.D. Vukasín¹, D.D. Shin¹, and T.W. Kenny¹
¹*Stanford University, USA and ²Apple, Inc., USA*

9:25 am  **TOWARDS REAL-TIME MIDDLE ULTRAVIOLET (MUV) LIGHT DETECTION BY BETA GALLIUM OXIDE (β-Ga₂O₃) NEMS OSCILLATOR**
X.-Q. Zheng¹, J. Lee¹, S. Rafique¹,², M. Rezaul Karim², L. Han¹,², H. Zhao², C.A. Zorman¹, and P.X.-L. Feng¹
¹*Case Western Reserve University, USA and ²Ohio State University, USA*

9:45 am  **SELF-SUSTAINED DUAL-MODE MECHANICAL FREQUENCY COMB SENSORS**
M. Park and A. Ansari
*Georgia Institute of Technology, USA*

10:05 am  Break and Table Top Exhibits
Session 8 - Late News Advanced Processes for Bio Applications
Session Chair: A. Lal, Cornell University, USA

10:30 am ENTERIC & 3D-PRINTED HYBRID PACKAGE FOR SAMPLING IN DIGESTIVE REGIONS
G.E. Banis, L.A. Beardslee, J.M. Stine, and R. Ghodssi
University of Maryland, USA

10:50 am ROBUST “RIBBED” NANOPOROUS MEMBRANES FOR IMPLANTABLE BIO-ARTIFICIAL KIDNEYS
B.W. Chui, P. Taheri-Tehrani, N. Wright, J. Ly, and S. Roy
University of California, San Francisco, USA

11:10 am AN ULTRASONICALLY POWERED IMPLANTABLE MICRO ELECTROLYTIC ABLATION (IMEA) FOR TUMOR NECROSIS
A.K. Majumdar, S. Islam, and A. Kim
Temple University, USA

11:30 am - Networking Lunch
1:00 pm

1:00 pm Workshop Adjourns
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**Poster Presentations - Session 1**
Contributed and Late News Posters
Monday, June 4 1:30 pm – 4:00 pm

**Acoustic Transducers and Delay Lines**

**MP-01**  A RADIO FREQUENCY NON-RECI PROCAL NETWORK BASED ON SWITCHED LOW-LOSS ACOUSTIC DELAY LINES
R. Lu, T. Manzaneque, Y. Yang, A. Gao, L. Gao, and S. Gong
*University of Illinois, Urbana-Champaign, USA*

**MP-02**  PMUT-BASED HIGH DATA RATE ULTRASONIC WIRELESS COMMUNICATION LINK FOR INTRA-BODY NETWORKS
*Northeastern University, USA*

**Bio-Inspiration and Biomedical Devices and Systems**

**MP-03**  ELECTRIC-FIELD INDUCED INCREASE IN PARACELLULAR VASCULAR PERMEABILITY
*Ohio State University, USA*

**MP-04**  MULTIMODAL INTELLIGENT TRANSWELL SYSTEM
P. Ramiah Rajasekaran, A. Chapin, D.N. Quan, S.H. Jang, L. Hu, J. Herberholz, W.E. Bentley, and R. Ghodssi
*University of Maryland, USA*

**Characterization, Fabrication and Materials**

**MP-05**  2D AND 3D DOPING OF SILICON MEMS STRUCTURES USING PHOSPHORUS-DOPED POLYSILICON AS A DOPANT SOURCE
P.J. Newby¹, K. Zandi¹, K. Côté¹, J.-P. Richard¹, K.-A. Belarbi²
¹*Miqro Innovation Collaborative Centre (C2MI), CANADA, and ²Teledyne DALSA Semiconductor Inc., CANADA*

**MP-06**  FABRICATION AND SUB-ASSEMBLY OF ELECTROSTATICALLY ACTUATED SILICON NITRIDE MICROSHUTTER ARRAYS
L.H. Oh¹, M.J. Li², K. Kim³, D. Kelly², A. Kutyré⁴, S.H. Moseley², N.P. Costen¹, and G. Manos²
¹*SGT Inc., USA, ²NASA, USA, ³ASRC Federal Corp., USA, and ⁴University of Maryland, USA*
MP-07  FABRICATION AND CHARACTERIZATION OF 3D PRINTED, 3D MICROELECTRODE ARRAYS WITH SPIN COATED INSULATION AND FUNCTIONAL ELECTROSPUN 3D SCAFFOLDS FOR “DISEASE IN A DISH” AND “ORGAN ON A CHIP” MODELS
N. Azim¹, T. Ausaf¹, A. Kundu¹, L. Zhai¹, and S. Rajaraman¹,²
¹University of Central Florida, USA and ²Bridging the Innovation Development Gap (BRIDG), USA

MP-08  FABRICATION OF SUB-MICRON METAL WIRES FOR HIGH-FREQUENCY LITZ WIRE
K.J. Russell¹, A. Aydin², D.J.D. Carter¹, E. Kim¹, P.H. Lewis¹, L. Sun², X. Gong², C. Chang², R. Gordon², and A. Duwel¹
¹Charles Stark Draper Laboratory, Inc., USA and ²Harvard University, USA

MP-09  FIRST FATIGUE MEASUREMENTS ON THICK EPI-POLYSILICON MEMS IN ULTRA-CLEAN ENVIRONMENT
A.L. Alter¹, I.B. Flader¹, Y. Chen², L. Comenencia Ortiz¹, D.D. Shin¹, D.B. Heinz¹, and T.W. Kenny¹
¹Stanford University, USA and ²Apple Inc., USA

MP-10  INCREASING THE THICKNESS AND DEPOSITION RATE OF HIGH-FREQUENCY ELECTROPLATED CoPt PERMANENT MAGNETS
Y. Wang, J. Ewing, and D.P. Arnold
University of Florida, USA

MP-11  MASKLESS 3D MICROFABRICATION OF DRUG-LADEN CAPSULATED MICROSTRUCTURES
L. Qi, S. Yuan, R.X. Xu, and Y. Zhao
Ohio State University, USA

MP-12  PRINTING BIOLOGICAL LIQUID ON HYDROPHOBIC 3D ELECTRODES
S. Chu, M.J. Lerman, J.N. Culver, J.P. Fisher, and R. Ghodssi
University of Maryland, USA

Chemical, Biomedical, and Gas Sensors

MP-13  A BIODEGRADABLE SENSOR HOUSED IN 3D PRINTED POROUS TUBE FOR IN-SITU SOIL NITRATE DETECTION
H. Jiang, W. Yu, R. Rahimi, and B. Ziaie
Purdue University, USA
MP-14  A SUB-PPB-LEVEL INTEGRATED ELECTROCHEMICAL HEAVY METAL ION MICROSENSOR
H. Jiang¹, C. Yang², K. Yang², and L. Dong²
¹Iowa State University, USA and ²Analog Devices Inc., USA

MP-15  FLEXIBLE IMPEDANCE SENSOR FOR WIRELESS MONITORING OF CATHETER BIOFILMS
University of Maryland, USA

Micro Robots

MP-16  FIRST LEAPS OF AN ELECTROSTATIC INCHWORM MOTOR-DRIVEN JUMPING MICROROBOT
J. Greenspun and K.S.J. Pister
University of California, Berkeley, USA

MP-17  SOFT ROBOTICS: FLUID-DRIVEN SELF-FOLDING PAPERS
H.-H. Chun, M. Mohammadifar, and S. Choi
State University of New York, Binghamton, USA

Microfluidics

MP-18  THE μHAMMER: INVESTIGATING CELLULAR RESPONSE TO IMPACT WITH A HIGH THROUGHPUT MICROFLUIDIC MEMS DEVICE
L.H.C. Patterson¹, J.L. Walker¹, E. Rodriguez-Mesa², K. Shields², J.S. Foster², M.T. Valentine¹, A.M. Doyle¹, and K.L. Foster¹,²
¹University of California, Santa Barbara, USA and ²Owl Biomedical, USA

MP-19  TRANSIENT BIOBATTERIES: MICROFLUIDIC CONTROL FOR PROGRAMMABLE DISSOLUTION
M. Mohammadifar and S. Choi
State University of New York, Binghamton, USA

MP-20  VOLTAGE GATED NANOFLOWDIFIC CHIP FOR PROTEIN CAPTURE, AMPLIFICATION, AND RELEASE
K.K. Rangharajan and S. Prakash
Ohio State University, USA
Modeling

MP-21  A FLEXIBLE, MICROFABRICATED IMPEDIMETRIC FLUID TEMPERATURE SENSOR
A. Baldwin, T. Hudson, E. Yoon, and E. Meng
*University of Southern California, USA*

MP-22  EFFECT OF DIELECTRIC LOSS ON THE QUALITY FACTORS OF PIEZOELECTRICALLY DRIVEN LENGTH EXTENSIONAL MODE RESONATORS
A. Qamar¹, S. Sherrit², X.-Q. Zhang³, J. Lee³, P.X.-L. Feng³, and M. Rais-Zadeh¹,²
¹University of Michigan, USA, ²California Institute of Technology, USA, and ³Case Western Reserve University, USA

Physical and Optical Sensors and Actuators

MP-23  BROADBAND LONG-WAVELENGTH INFRARED MICROMECHANICAL PHOTOSWITCH FOR ZERO-POWER HUMAN DETECTION
S. Kang, S.D. Calisgan, Z. Qian, V. Rajaram, N.E. McGruer, and M. Rinaldi
*Northeastern University, USA*

MP-24  FBAR-BASED SENSOR FOR WIRELESS RFID AUTHENTICATION OF INTEGRATED CIRCUITS
A.A. Shkel, M. Barekatain, and E.S. Kim
*University of Southern California, USA*

MP-25  THE EFFECT OF BIAS CONDITIONS ON AlGaN/GaN 2DEG HALL PLATES
K.M. Dowling¹, H.S. Alpert¹, P. Zhang², A.N. Ramirez¹, A.S. Yalamarthy¹, H. Köck³, U. Ausserlechner³, and D.G. Senesky¹
¹Stanford University, USA, ²Tsinghua University, CHINA, and ³Infineon Technologies AG, AUSTRIA

MP-26  TRENCH-ISOLATED BULK-TYPE PRESSURE SENSOR ON SILICON-ON-INSULATOR FOR HIGH-TEMPERATURE AND HIGH-PRESSURE DOWNHOLE APPLICATIONS
E. Chan¹, D. Lin¹,²,³, L. Lu¹,⁴, K. Chau¹,², and M. Wong¹
¹Hong Kong University of Science and Technology, HONG KONG, ²Chinese Academy of Sciences, CHINA, ³University of Chinese Academy of Sciences, CHINA, and ⁴Hong Kong University of Science and Technology
Power Generation and Management

MP-27 A YARN-BASED BACTERIA-POWERED BATTERY FOR SMART TEXTILES
Y. Gao, L. Liu, and S. Choi
State University of New York, Binghamton, USA

Resonant Devices

MP-28 A NANOMECHANICAL IDENTIFICATION TAG TECHNOLOGY FOR TRACEABILITY AND AUTHENTICATION APPLICATIONS
M. Ramezani, A.R. Newsome, M. Ghatge, F. Zhang, S. Bhunia, and R. Tabrizian
University of Florida, USA

MP-29 CIRCULARLY POLARIZED MECHANICAL RESONANCES
P.-L. Yu and S.A. Bhave
Purdue University, USA

MP-30 ENHANCING MICRO-OVEN POWER AND STIFFNESS IN ENCAPSULATED DEVICES FOR TIMING REFERENCE APPLICATIONS
L. Comenencia Ortiz\(^1\), D.D. Gerrard\(^1\), I.B. Flader\(^1\), G.D. Vukasin\(^1\), D.B. Heinz\(^1\), J. Rodriguez\(^1\), S. Koppaka\(^1\), D.D. Shin\(^1\), H.-K. Kwon\(^1\), S. Chandorkar\(^2\), and T.W. Kenny\(^1\)
\(^1\)Stanford University, USA and \(^2\)IISc Bangalore, INDIA

MP-31 HIGH K\(_t\)\(^2\)Q LAMB-WAVE SCALN-ON-SILICON UHF AND SHF RESONATORS
M. Ghatge\(^1\), V. Felmetsger\(^2\), and R. Tabrizian\(^1\)
\(^1\)University of Florida, USA and \(^2\)OEM Group LLC., USA

Late News

MP-32 3D PRINTED MICROFLUIDIC SELECTABLE RATIO MIXER PUMP IN 2 MM\(^3\)
G.P. Nordin, H. Gong, and A.T. Woolley
Brigham Young University, USA

MP-33 A FULLY-INTEGRATED WEARABLE MICROFLUIDIC ACTUATION AND SENSING PLATFORM FOR BIOMARKER ANALYSIS
H. Lin\(^1\), S. Lin\(^1\), Y. Zhao\(^1\), H. Hojajii\(^1\), S. Pilehvar\(^1\), S. Thakur\(^2\), M. Karapetian\(^1\), K. King\(^1\), R. Frias\(^1\), and S. Emaminejad\(^1\)
\(^1\)University of California, Los Angeles, USA and \(^2\)University of California, Berkeley, USA
MP-34  A HIGHLY SENSITIVE IMPEDIMETRIC APTASENSOR FOR WEARABLE DETECTION OF HORMONES  
S. Pilehvar, S. Lin, H. Hojaiji, Y. Zhao, and S. Emaminejad  
University of California, Los Angeles, USA

MP-35  AN ULTRASONICALLY POWERED ACTIVE STENT FOR ENDOVASCULAR DISEASES  
S. Islam and A. Kim  
Temple University, USA

MP-36  ELECTROCHEMICALLY-FUNCTIONALIZED AND VERTICALLY CONDUCTIVE ADHESIVE TAPES FOR WEARABLE SWEAT BIOMARKER MONITORING  
Y. Zhao, H. Hojaiji, and S. Emaminejad  
University of California, Los Angeles, USA

MP-37  HOLLOW FLEXURAL RESONATORS WITH NANOSCALE THICKNESS  
University of Pennsylvania, USA

MP-38  IMPLANTABLE, MICROFIBER NEUROELECTRODES FABRICATED OUT OF POLycrystalline DIAMOND AND BORON-DOPED DIAMOND  
Y. Guo¹, C.A. Rusinek², R. Rechenberg², B. Fan¹, M.F. Becker², and W. Li¹  
¹Michigan State University, USA, and ²Fraunhofer USA, USA

MP-39  TEMPERATURE-DEPENDENT TRANSIENT BEHAVIOR OF AlGaN/GaN HIGH ELECTRON MOBILITY PRESSURE SENSORS  
C.A. Chapin¹, K.M. Dowling¹, H.-P. Phan¹,², R. Chen¹, and D.G. Senesky¹  
¹Stanford University, USA and ²Griffith University, AUSTRALIA

MP-40  WHAT IS EFFECTIVE QUALITY FACTOR?  
J.M. Lehto Miller¹, A. Ansari², D.B. Heinz¹, Y. Chen¹, I.B. Flader¹, D.D. Shin¹, L.G. Villanueva³, and T.W. Kenny¹  
¹Stanford University, USA, ²Georgia Institute of Technology, USA, and ³École Polytechnique Fédérale de Lausanne, SWITZERLAND
**Acoustic Transducers and Delay Lines**

**WP-01** REALIZING RADIO FREQUENCY ACOUSTIC DELAYS AND TRANSVERSAL FILTERING WITH SUB-2 DB INSERTION LOSS AND 10% FRACTIONAL BANDWIDTH
T. Manzaneque, R. Lu, Y. Yang, and S. Gong
*University of Illinois, Urbana-Champaign, USA*

**WP-02** LOW THERMAL BUDGET SURFACE MICROMACHINING PROCESS FOR PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCER ARRAYS WITH IN-SITU VACUUM SEALED CAVITIES
Q. Wang, G. Luo, Y. Kusano, and D.A. Horsley
*University of California, Davis, USA*

**Bio-Inspiration and Biomedical Devices and Systems**

**WP-03** A TWO-MINUTE ASSAY FOR ELECTRONIC QUANTIFICATION OF ANTIBODIES IN SALIVA ENABLED THROUGH MULTI-FREQUENCY IMPEDANCE CYTOMETRY AND MACHINE LEARNING ANALYSIS
Z. Lin, J. Sui, P. Xie, K. Ahuja, and M. Javanmard
*Rutgers University, USA*

**WP-04** MULTI-MODAL MICROELECTRODE ARRAYS FOR THE INVESTIGATION OF PROTEIN ACTIN'S ELECTRO-MECHANOSENSING MECHANISMS TOWARD NEURODEGENERATIVE DISEASE MODELS ON A CHIP
N. Azim, N. Castaneda, A. Diaz, H. Kang, and S. Rajaraman
*University of Central Florida, USA*

**Characterization, Fabrication and Materials**

**WP-05** A SIMPLE FABRICATION METHOD FOR DOUBLY REENTRANT OMNIPHOBIC SURFACES VIA STRESS INDUCED BENDING
K.L. Wilke, M. Garcia, D.J. Preston, and E.N. Wang
*Massachusetts Institute of Technology, USA*

**WP-06** ACTIVE SELF-CLEANING SURFACES ON SOLAR MODULES
D. Sun and K.F. Böhringer
*University of Washington, USA*
WP-07  DIRECTED SELF ASSEMBLY OF COLLOIDAL PARTICLES FOR HIGH ASPECT RATIO BANDS
V. Lochab\textsuperscript{1}, A. Yee\textsuperscript{2}, Y. Li\textsuperscript{3}, M. Yoda\textsuperscript{2}, A.T. Conlisk\textsuperscript{1}, and S. Prakash\textsuperscript{1}
\textsuperscript{1}Ohio State University, USA, \textsuperscript{2}Georgia Institute of Technology, USA, and \textsuperscript{3}Ibaraki University, JAPAN

WP-08  MECHANICAL CHARACTERIZATION OF ADDITIVELY MANUFACTURED MICROSTRUCTURES USING A PROCESS INTEGRATED MEMS TENSILE TESTER
I.S. Ladner\textsuperscript{1,2}, J.H. Cho\textsuperscript{2}, D.R. Cayll\textsuperscript{2}, V.H. Nguyen\textsuperscript{1}, M.A. Cullinan\textsuperscript{2}, and S.K. Saha\textsuperscript{1}
\textsuperscript{1}Lawrence Livermore National Laboratory, USA and \textsuperscript{2}University of Texas, Austin, USA

WP-09  MULTILAYER ALD CERAMIC FILMS FOR ENHANCEMENT OF PARYLENE BARRIER PROPERTIES IN COMPLIANT NEURAL PROBES WITH BONDED CHIPS
M. Forssell, X.C. Ong, and G.K. Fedder
Carnegie Mellon University, USA

WP-10  NANOPRINTING OF MINIATURE COMPOUND REFRACTIVE LENSES FOR DESKTOP HARD X-RAY IMAGING
M. Mirzaeimoghri\textsuperscript{1,2}, A. Morales\textsuperscript{1}, C. McCue\textsuperscript{2}, D.L. DeVoe\textsuperscript{2}, and H. Wen\textsuperscript{1}
\textsuperscript{1}National Institute of Health, USA and \textsuperscript{2}University of Maryland, USA

WP-11  NANOSTENCIL FABRICATION WITH DOUBLE EXPOSURE OPTICAL LITHOGRAPHY FOR SCALABLE RESIST-FREE PATTERNING OF METAL ON POLYMERS
J.S. Katz\textsuperscript{1}, W. Park\textsuperscript{1}, M.T. Barako\textsuperscript{2}, A. Sood\textsuperscript{1}, M. Asheghi\textsuperscript{1}, and K.E. Goodson\textsuperscript{1}
\textsuperscript{1}Stanford University, USA and \textsuperscript{2}Northrup Grumman Corporation, USA

WP-12  NOVEL ROOM TEMPERATURE MICROFLUIDIC DEVICE FABRICATION: A HIGH RESOLUTION, 3D PRINTING APPROACH USING ELECTROHYDRODYNAMIC JET PRINTING
C. Pannier\textsuperscript{1}, Z. Wang\textsuperscript{2}, D. Hoelzle\textsuperscript{3}, and K. Barton\textsuperscript{1}
\textsuperscript{1}University of Michigan, USA, \textsuperscript{2}University of Notre Dame, USA, and \textsuperscript{3}Ohio State University, USA

WP-13  PRECISE MICROSCALE PATTERNING OF BEAD LESS AND UNIFORM NANOFIBER VIA EXTREME NEAR-FIELD ELECTROSPINNING
D. Shin, J. Kim, and J. Chang
University of Utah, USA
Chemical, Biomedical, and Gas Sensors

WP-14 A MICRO COLLECTOR INJECTOR (μCOIN) FOR μGC SYSTEMS
M. Akbar, N. Nuñovero, R. Hower, C. Zhan, J. Potkay, and E. Zellers
University of Michigan, USA

WP-15 ENHANCING SELECTIVITY OF CANTILEVER-BASED RESONANT CHEMICAL SENSORS THROUGH TRANSIENT MEASUREMENTS AT ELEVATED TEMPERATURES
P. Getz\textsuperscript{1}, C. Carron\textsuperscript{1,2}, and O. Brand\textsuperscript{1}
\textsuperscript{1}Georgia Institute of Technology, USA and \textsuperscript{2}Harris Corporation, USA

WP-16 MATTRESS-BASED SWEAT MONITORING FOR HUMAN HEALTH MONITORING AND SMART HOMES
S. Pavlidis\textsuperscript{1,2}, M.-Y. Tsai\textsuperscript{2}, B. Brown\textsuperscript{2}, D. Jin\textsuperscript{2}, J.-D. Velilla\textsuperscript{3}, M. Defranks\textsuperscript{3}, and E. Vogel\textsuperscript{2}
\textsuperscript{1}North Carolina State University, USA, \textsuperscript{2}Georgia Institute of Technology, USA, and \textsuperscript{3}Serta Simmons Bedding, USA

WP-17 RAPID DIFFERENTIATION OF HOST AND PARASITE EXOSOME VESICLES USING PHOTONIC CRYSTAL BIOSENSOR
Y. Wang, W. Yuan, M. Kimber, M. Lu, and L. Dong
Iowa State University, USA

Micro Robots

WP-18 MEMS AIRFOIL WITH INTEGRATED INCHWORM MOTOR AND FORCE SENSOR
B. Kilberg, D. Contreras, J. Greenspun, H. Gomez, E. Liu, and K.S.J. Pister
University of California, Berkeley, USA

Microfluidics

WP-19 CMOS COMPATIBLE GHz ULTRASONIC FRENSNEL MICROFLUIDIC ACTUATOR
A. Ravi, J. Kuo, and A. Lal
Cornell University, USA

Modeling

WP-20 A 5-BIT DIGITALLY OPERATED MEMS ACCELEROMETER
A. Abbasalipour\textsuperscript{1}, V. Kumar\textsuperscript{1}, R. Jafari\textsuperscript{2}, and S. Pourkamali\textsuperscript{1}
\textsuperscript{1}University of Texas, Dallas, USA and \textsuperscript{2}Texas A&M University, USA
WP-21 ON DECOUPLED QUANTIFICATION OF ENERGY DISSIPATION MECHANISMS IN TOROIDAL RING GYROSCOPES
Y. Wang¹, Y.-W. Lin¹, J. Rodriguez², G.D. Vukasin², D.D. Shin², H.-K. Kwon², D.B. Heinz², Y. Chen², D.D. Gerrard², T.W. Kenny², and A.M. Shkel¹
¹University of California, Irvine, USA and ²Stanford University, USA

Physical and Optical Sensors and Actuators

WP-22 CAPACITIVE TRANSDUCER ENHANCEMENT ON QUADRATURE COMPENSATION ELECTRODE OF YAW RATE GYROSCOPE
P. Shao, E. Canales, and P. Zhu
NXP Semiconductors, USA

WP-23 FACILE FABRICATION OF LOW-COST PASSIVE WIRELESS HUMIDITY SENSOR FOR SMART PACKAGING VIA ALL-LASER PROCESSING OF METALIZED PAPER
R. Rahimi¹,², J. Zhou¹,², H. Jiang¹,², T. Soleimani³, and B. Ziaie¹,²
¹Purdue University, USA, ²Birk Nanotechnology Center, USA, and ³Michigan State University, USA

WP-24 NANOSCALE TUNING FORK CAVITY OPTOMECHANICAL TRANSDUCERS WITH DESIGN ENABLED FREQUENCY TUNING AND TEMPERATURE COMPENSATION
R. Zhang¹, R. Ilic², Y. Liu¹, and V. Aksyuk²
¹Worcester Polytechnic Institute, USA, and ²National Institute of Standards and Technology (NIST), USA

WP-25 SMARTPHONE BASED FOCUS-FREE MACROSCOPY USING AN ADAPTIVE DROPLET LENS
H. Huang and Y. Zhao
Ohio State University, USA

WP-26 TWO-CHANNEL WAKEUP SYSTEM EMPLOYING ALUMINUM NITRIDE BASED MEMS RESONANT ACCELEROMETERS FOR NEAR-ZERO POWER APPLICATIONS
Sandia National Laboratories, USA
Power Generation and Management

WP-27 MICRO BUCKLED BEAM BASED ULTRA-LOW FREQUENCY VIBRATION ENERGY HARVESTER
R. Xu, H. Akay, and S.-G. Kim
Massachusetts Institute of Technology, USA

Resonant Devices

WP-28 A SINGLE-CRYSTAL SILICON RESONATOR FOR AM DEMODULATION WITH ADDED SECOND-HARMONIC MODULATION
M.E. Galanko, Y.-C. Lin, T. Mukherjee, and G.K. Fedder
Carnegie Mellon University, USA

WP-29 CROSS-SECTIONAL QUASI-LAMÉ MODES IN THIN-FILM PIEZOELECTRIC-ON-SILICON RESONATORS
S. Shahraini¹, H. Fatemi², and R. Abdolvand¹
¹University of Central Florida, USA and ²Qorvo, USA

WP-30 EIGENMODE OPTIMIZATION AND TOPOLOGICALLY PROTECTED STATES IN MAGNETO-MECHANICAL ULF TRANSMITTER ARRAYS
I. Grinberg, J. Kim, and G. Bahl
University of Illinois, Urbana-Champaign, USA

WP-31 PRECISE LOCAL TEMPERATURE MEASUREMENT OF FULLY ENCAPSULATED OVENIZED MEMS DEVICES
H.-K. Kwon¹, D.B. Heinz¹, D.D. Shin¹, Y. Chen², L.C. Ortiz¹, G.D. Vukasin¹, and T.W. Kenny¹
¹Stanford University, USA and ²Apple, Inc., USA

Late News

WP-32 750 MHZ ZERO-POWER MEMS-BASED WAKE-UP RECEIVER WITH -60 DBM SENSITIVITY
Northeastern University, USA
WP-33 A HIGH-MASS, EIGHT-FOLD SYMMETRIC SILICON CARBIDE MEMS GYROSCOPE  
E. Cook¹, M. Tomaino-Iannucci¹, J. Bernstein¹, M. Weinberg¹, J. Choy¹, K. Hobart², L. Luna², M. Tadjer², R. Myers-Ward², F. Kub², Y. Yang³, E. Ng³, I. Flader, Y. Chen³, and T. Kenny³  
¹Draper, USA, ²U.S. Naval Research Laboratory, USA, and ³Stanford University, USA

WP-34 A SILICON OPTOMECHANICAL ACCELEROMETER WITH HIGH BANDWIDTH AND SENSITIVITY  
Y. Bao¹,², F. Zhou¹, T.W. LeBrun¹, and J.J. Gorman¹  
¹National Institute of Standards and Technology (NIST), USA and ²Theiss Research, USA

WP-35 DEMONSTRATION OF A MICROFABRICATED SELF-OSCILLATING FLUIDIC HEAT ENGINE (SOFHE)  
T. Monin¹,²,³, A. Tessier-Poirier¹, A. Amnache¹, T. Skotnicki³, S. Monfray³, F. Formosa², and L.G. Fréchette¹  
¹Université de Sherbrooke, FRANCE, ²Université Savoie-Mont-Blanc, FRANCE, and ³STMicroelectronics, FRANCE

WP-36 DIRECT MEASUREMENTS OF ANCHOR DAMPING IN PRESSURE-LIMITED RING RESONATORS  
G.D. Vukasin¹, J. Rodriguez¹, L. Comenencia Ortiz¹, G.M. Glaze¹, D.D. Gerrard¹, C.H. Ahn¹, Y. Yang², J. Lake³, R.N. Candler⁴, and T.W. Kenny¹  
¹Stanford University, USA, ²Integrated Device Technology Incorporated, USA, ³uBeam, USA, and ⁴University of California, Los Angeles, USA

WP-37 IMAGING GIGAHERTZ DYNAMICS IN MICROMECHANICAL RESONATORS USING ULTRAFAST PULSED LASER INTERFEROMETRY  
L. Shao¹,², V.J. Gokhale¹,², J.C. Kuo³, A. Lal³, and J.J. Gorman¹  
¹National Institute of Standards and Technology (NIST), USA, ²University of Michigan, USA, and ³Cornell University, USA

WP-38 KNUDSEN-PUMP-BASED MICRO-HOVERCRAFTS  
J. Cortes, C. Stanczak, and I. Bargatin  
University of Pennsylvania, USA

WP-39 ORIGAMI-ENABLED MICROFLUIDICS  
X. Xie¹, C. Kelly¹, T. Liu¹, R.J. Lang², S. Gandolfo¹, Y. Boukataya³, and C. Livermore¹  
¹Northeastern University, USA, ²Lang Origami, USA, and ³University of Pennsylvania, USA
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A RISING JOURNAL FROM NATURE PUBLISH GROUP: MICROSYSTEMS & NANOENGINEERING  
T. Cui¹, T. Liu¹, and Y. Zhang²  
¹University of Minnesota, USA and  
²Chinese Academy of Sciences, CHINA

**WCP-02**  
CAVITY SOI AND PATTERNED Si SUBSTRATES FOR MEMS AND SENSORS  
V.-P. Lempinen and G. Stoeva  
Okmetic, FINLAD and Okmetic, Inc., USA

**WCP-03**  
COMPREHENSIVE MEMS DESIGN ANALYSIS WITH CoventorMP  
R. Jhaveri and S. Breit  
Coventor, Inc., USA

**WCP-04**  
CUSTOMIZED MEMS SOLUTIONS FOR PROOF-OF-PRINCIPLE THROUGH MEDIUM-VOLUME PRODUCTION  
J. Walker¹, H. Van den Vlekkert², R. Heideman², and A. Leinse²  
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²LioniX International, THE NETHERLANDS

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DWL 66+: MASKLESS LASER LITHOGRAPHY WITH THE ULTIMATE LITHOGRAPHY RESEARCH TOOL  
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¹Heidelberg Instruments GmbH, GERMANY and  
²Heidelberg Instruments, Inc., USA

**WCP-06**  
FULL OPTICAL CHARACTERIZATION OF MEMS: REAL TIME DYNAMICS AND 3D TOPOGRAPHY  
E. Lawrence¹, D. Oliver¹, M. Heilig², and H. Steger²  
¹Polytec Inc., USA and ²Polytec GmbH, GERMANY

**WCP-07**  
HIGH RELIABLE PZT SPUTTERING TECHNOLOGIES FOR HIGH PERFORMANCE PIEZOMEMS DEVICES  
H. Kobayashi, T. Tsuyuki, I. Kimura, and K. Suu  
ULVAC, Inc., JAPAN
WCP-08 HIGH THROUGHPUT LARGE FEATURE LITHOGRAPHY WITHOUT THE NEED FOR PHOTOMASKS
J. Sasserath and J. Drakeford
Advanced Micro Patterning, USA

WCP-09 MOLECULAR VAPOR DEPOSITION (MVD): A VERSATILE, MULTIFUNCTIONAL TECHNOLOGY FOR IMPROVING PERFORMANCE AND RELIABILITY OF MEMS BASED PRODUCTS
D. Springer, M. Grimes, and K. Atchison
SPTS Technologies, USA

WCP-10 REVISITING THE SEMINAL BOSCH DEEP REACTIVE ION ETCH PATENT
S. Dixon-Warren
TechInsights Inc., CANADA

WCP-11 THE DHM (DIGITAL HOLOGRAPHY MICROSCOPE) AS ADVANCED 4D MEMS ANALYZER AND PROFILOMETER
Y. Emery, J. Parent, and F. Liu
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WOP-02 3-AXIS ACCELEROMETER CALIBRATION PROTOCOL FOR LABORATORY INTER-COMPARISONS BASED ON INTRINSIC PROPERTIES
M. Gaitan
National Institute of Standards and Technology (NIST), USA

WOP-03 3D MICRO LASER SINTERING FOR METAL SENSORS AND ACTUATORS
R.C. Roberts
University of Hong Kong, HONG KONG

WOP-04 A HIGH-TEMPERATURE OPTICAL SAPPHIRE PRESSURE SENSOR FOR HARSH ENVIRONMENTS
H. Zhou¹, A. Vera¹, D. Mills², A. Garraud¹, and M. Sheplak¹
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WOP-05 COUPLING NANOMECHANICAL RESONATORS WITH QUANTUM EMITTERS IN WIDE-BANDGAP SEMICONDUCTORS FOR HYBRID QUANTUM SYSTEMS
Y. Wang, J. Lee, V. Zhou, C. Main, S. Amponsah, and P.X.-L. Feng
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WOP-07 ELECTROSTATIC ACTUATOR TO BIAS CELL FLOW AT A MICROFLUIDIC CHANNEL BIFURCATION
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WOP-08 HIGH-MAGNETIC-MOMENT MICRODISCS FOR EFFICIENT CAPTURE, CONCENTRATION, AND ASSAY OF BACTERIA IN WATER SAMPLES
K. Castillo-Torres, E. McLamore, and D. Arnold
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WOP-11 MECHANISTIC DETERMINATION OF ELECTROCEUTICAL BACTERICIDAL EFFECTS ON PSEUDOMONAS AERUGINOSA BIOFILMS
Ohio State University, USA
WOP-12  PROGRAMMABLE & RECONFIGURABLE SUSTAINING AMPLIFIERS FOR MEMS/NEMS REFERENCED MULTIMODE OSCILLATORS
M.S. Islam, J. Lee, R. Wei, P.X.-L. Feng, and S. Mandal
Case Western Reserve University, USA

WOP-13  PUSHING THE BOUNDARIES OF PIEZORESISTIVE PRESSURE SENSORS
G. van Sprakelaar, F. Alfaro, and J. Gaynor
Silicon Microstructures, Inc., USA

WOP-14  SCALABLE MICRO OBJECT ASSEMBLY AND TRANSFER
E.M. Chow, J.P. Lu, A. Plochowetz, B. Rupp, J.A. Bert,
S. Raychoudhuri, P. Maeda, M. Shreve, S. Butylkov,
L. Crawford, D.K. Biegelsen, and Y. Wang
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