



THE 34TH IEEE INTERNATIONAL CONFERENCE
ON MICRO ELECTRO MECHANICAL SYSTEMS

MEMS2021

ONLINE

FINAL PROGRAM

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The IEEE MEMS Technical Community aims to cultivate and support activities that grow the MEMS field and help members stay abreast of the latest in MEMS ideas, designs, and manufacturing technologies. Activities underway include sponsoring conferences, generating publications, promoting MEMS researchers and practitioners with awards (including IEEE Fellow status), generating educational content, and preserving the history of MEMS.



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Suzhou Minxin Microelectronics Technology Co., Ltd. was established in September 2007. It is a high-tech enterprise specializing in the R&D and design of microelectronic mechanical system sensors. The company is headquartered in Suzhou Industrial Park and has sensor products in Suzhou Industrial Park and Kunshan.

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The Institute of Technological Sciences (ITS) was founded by Wuhan University in 2017 and is independent of but directly affiliated with the University. The scientific research at the ITS is cross-disciplinary and based on the engineering disciplines of Wuhan University. The Institute's major areas of focus are advanced manufacturing, advanced materials and micro/nanoelectromechanical system (M/NEMS). The ITS is an international, intellectual community that encourages diversity, openness, and creative learning. The Institute welcomes outstanding talents from around the world who can contribute their diverse perspectives and experiences to its global education and research environment.

Interdisciplinary Microsystems Group (IMG), University of Florida

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Founded in 1998, the Interdisciplinary Microsystems Group (IMG) is a college-wide multi-departmental education and research program of the Herbert Wertheim College of Engineering at the University of Florida. IMG operates under the direction of 10 faculty members in [Electrical & Computer Engineering](#), [Mechanical & Aerospace Engineering](#), and [Materials Science & Engineering](#). IMG research focuses on design, fabrication, characterization, and ultimately deployment of micro and nanosystems for a broad range of applications including internet of things (IoT), biomedical and healthcare, energy, security, aerospace, transportation, agriculture, electronics, photonics, nanotechnology, and quantum engineering. IMG is actively looking for talented students and postdoctoral researchers.

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Silex Microsystems, the world's largest pure-play MEMS foundry, is driving the sensory system revolution, partnering with the world's most innovative companies to commercialize MEMS technologies that can change the world.

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The Robert Bosch Micro and Nano Electro Mechanical Systems Award was established by the IEEE Electron Devices Society in 2014 to recognize and honor advances in the invention, design, and/or fabrication of micro- or nano- electromechanical systems and/or devices.

The 2021 Bosch Award will be presented virtually on Monday, 25 January at 08:00 (Eastern - New York).

Chang-Jin “CJ” Kim

For Pioneering Surface-Tension-Based Microelectromechanical Systems (MEMS) that led to Electrowetting Digital Microfluidics and Superhydrophobic Drag Reduction.



Chang-Jin “CJ” Kim is a Distinguished Professor and holds the Volgenau Endowed Chair in Engineering at the University of California, Los Angeles (UCLA), with a main appointment in Mechanical and Aerospace Engineering Department. He received B.S. from Seoul National University, M.S. from Iowa State University, and Ph.D. from the University of California, Berkeley, and had a postdoctoral visit to the University of Tokyo before joining UCLA in 1993. Directing the Micro and Nano Manufacturing Lab, Prof. Kim performs research in MEMS with a focus on utilizing surface tension as a mechanical force. The recipient of Research Excellence Award (Iowa State Univ.), TRW Outstanding Young Teacher Award (UCLA), NSF CAREER Award, Association for Laboratory Automation (ALA) Achievement Award, Samueli Outstanding Teacher Award (UCLA), and Ho-Am Prize in Engineering (the Ho-Am Foundation), he has been involved with numerous professional activities, including General Chair of the 2014 IEEE International Conference on MEMS. An ASME Fellow and an AIMBE Fellow, he is currently serving on the Editorial Board of the IEEE Journal of MEMS, on the Editorial Advisory Board for the IEEE Transactions on Electrical and Electronic Engineering, on the Editorial Board of Micro and Nano Systems Letters, as a Co-Editor-in-Chief of Functional Composites and Structures, on the International Steering Committee of Transducers, and on the International Steering Committee of Electrowetting Conference. A member of Council of Korean Americans (CKA), Prof. “CJ” Kim has also been active in the commercial sector as a consultant, advisor, and startup founder.

Day 1 - Monday, 25 January

Welcome Address

07:45 MEMS 2021 Conference Chairs
Philip Feng, *University of Florida, USA*
Niclas Roxhed, *KTH Royal Institute of Technology, SWEDEN*
Haixia "Alice" Zhang, *Peking University, CHINA*

IEEE Electron Devices Society Robert Bosch Micro and Nano Electro Mechanical Systems Award

08:00 Award Recipient
Chang-Jin "CJ" Kim
University of California, Los Angeles, USA

Plenary Speaker Presentation I

Session Chair:
Niclas Roxhed, *KTH Royal Institute of Technology, SWEDEN*

08:15 MICROTECHNOLOGIES AND NANOTECHNOLOGIES IN DRUG DELIVERY
Robert S. Langer
Massachusetts Institute of Technology, USA

09:00 - 09:05 Transition Break

Session Ia - Laser Machining & 3D Structures

Session Chair:
Franz Lärmer, *Robert Bosch GmbH, GERMANY*

09:05 MICRO HEMISPHERICAL RESONATORS WITH QUALITY FACTOR OF 1.18 MILLION FABRICATED VIA LASER ABLATION
Yan Shi¹, Kun Lu¹, Bin Li¹, Yimo Chen¹, Xiang Xi¹, Yulie Wu¹, Xuezhong Wu^{1,2}, and Dingbang Xiao^{1,2}
¹National University of Defense Technology, CHINA and ²Hunan MEMS Research Center, CHINA

09:20 3D NANOPRINTED EXTERNAL MICROFLUIDIC STRUCTURES VIA EX SITU DIRECT LASER WRITING
Ruben Acevedo, Ziteng Wen, Ian B. Rosenthal, Emmett Z. Freeman, Michael Restaino, Noemi Gonzalez, and Ryan D. Sochol
University of Maryland, College Park, USA

09:35 MICROMACHINED MULTI-ION SOURCES INTEGRATED MICRO-FLUIDIC CHANNELS
Nguyen-Van Chinh, Le-Van Minh, Takahito Ono, and Hiroki Kuwano
Tohoku University, JAPAN

Session Ib - Drug Delivery

Session Chair:

Wen Li, Michigan State University, USA

- 09:05 A DISSOLVABLE MICRONEEDLE PATCH BASED ON MEDICAL ADHESIVE TAPE FOR TRANSDERMAL DRUG DELIVERY**
Tingyu Li^{1,2}, Junshi Li¹, Zhongyan Wang¹, Yingjie Ren^{1,2}, Yufeng Jin², Dong Huang¹, Qining Wang¹, and Zhihong Li¹
¹Peking University, CHINA and ²Peking University Shenzhen Graduate School, CHINA
- 09:20 FIRST MICRO SWIRL NOZZLE FOR FAST DRUG DELIVERY TO THE LUNG**
Torben S. Last, Göran Stemme, and Niclas Roxhed,
KTH Royal Institute of Technology, SWEDEN
- 09:35 ULTRASOUND-TRIGGERED DRUG RELEASE FROM HYDROGEL MICROSPHERES WITH RELEASE BOOSTER**
Takeshi Kubota¹, Yuta Kurashina², and Hiroaki Onoe¹
¹Keio University, JAPAN and ²Tokyo Institute of Technology, JAPAN

Session Ic - Self-Powered/Wireless Sensors & Actuators

Session Chair:

Philippe Basset, Université Gustave Eiffel, FRANCE

- 09:05 AN ELECTROSPUN PVDF-TRFE/MXENE NANOFIBROUS MAT-BASED SELF-POWERED MOTION SENSOR**
S M Sohel Rana, M. Toyabur Rahman, M. Salauddin, Hyunok Cho, and Jae Y. Park
Kwangwoon University, KOREA
- 09:20 DOUBLE-SIDED LASER-INDUCED GRAPHENE BASED SMART BRACELET FOR SENSING AND ENERGY**
Haobin Wang, Zehua Xiang, Ji Wan, Yu Song, and Haixia Zhang
Peking University, CHINA
- 09:35 DUAL-TRANSDUCTION ELECTROMECHANICAL RECEIVER FOR NEAR-FIELD WIRELESS POWER TRANSMISSION**
Spencer E. Smith, Miah A. Halim, Adrian A. Rendon-Hernandez, and David P. Arnold
University of Florida, USA

09:50 – 09:55 Transition Break

Flash Poster Presentation I

09:55 - 10:30

Poster Session I

10:30 – 11:30 Presentations are listed by topic category with their assigned number starting on page 31.

11:35 – 11:35 Transition Break

Invited Speaker Presentation Ia

Session Chair:

Núria Barniol, Universitat Autònoma de Barcelona, SPAIN

11:35 TUBULAR MICROMOTORS AND MICROROBOTS FOR BIOMEDICAL APPLICATIONS

Oliver G. Schmidt

Institute for Integrative Nanosciences, Leibniz IFW Dresden, GERMANY

Invited Speaker Presentation Ib

Session Chair:

Cheng-Yao Lo, National Tsing Hua University, TAIWAN

11:35 NANOFABRICATION TOWARD HIGH-RESOLUTION AND LARGE AREA

Wen Qiao¹, Donglin Pu¹, and **Lin-Sen Chen**^{1,2}

¹Soochow University, CHINA and ²SVG Optronics, Co., Ltd, CHINA

12:05 - 12:10 Transition Break

Session IIa - Robot/Tactile Sensors

Session Chair:

Robert "Chris" Roberts, University of Texas, El Paso, USA

12:10 ETHANOL DRIVEN MICRO-ROBOTS WITH PHOTONIC COLLOIDAL CRYSTAL HYDROGEL FOR EXPLORING AND SENSING STIMULI

Koki Yoshida, Shota Yamawaki, and Hiroaki Onoe

Keio University, JAPAN

12:25 BIOINSPIRED LIQUID METAL BASED SENSING SYSTEM FOR COMPLIANCE DETECTION

Haotian Chen, Ivan Furfaro, and Stéphanie P. Lacour

École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

12:40 A HYBRID IONIC NANOFIBROUS MEMBRANE BASED PRESSURE SENSOR WITH ULTRA-HIGH SENSITIVITY OVER BROAD PRESSURE RANGE FOR WEARABLE HEALTHCARE APPLICATIONS

Sudeep Sharma, Ashok Chhetry, Seokgyu Ko, and Jae Yeong Park

Kwangwoon University, KOREA

12:55 HEART SOUND MONITORING BASED ON A PIEZOELECTRIC MEMS ACOUSTIC SENSOR

Mengjiao Qu, Dengfei Yang, Xuying Chen, Dongsheng Li, Ke Zhu, and Jin Xie

Zhejiang University, CHINA

Session IIb - Nanofabrication & Surface Engineering

Session Chair:

Sten Vollebregt, Delft University of Technology, NETHERLANDS

- 12:10 REWRITABLE OPTICAL STORAGE MEDIUM OF SILK PROTEINS USING TIP-BASED NANOLITHOGRAPHY**
Zhitao Zhou¹, Woonsoo Lee², Xinzhong Chen³, Nan Qin¹, Jianjuan Jiang¹, Keyin Liu¹, Mengkun Liu³, and Tiger H. Tao^{1,4}
¹Chinese Academy of Sciences, CHINA, ²University of Texas, Austin, USA, ³Stony Brook University, USA, and ⁴University of Chinese Academy of Sciences, CHINA
- 12:25 BIONIC ARTIFICIAL COMPOUND EYES IMAGING SYSTEM BASED ON PRECISION ENGRAVING**
Yueqi Zhai, Jiaqi Niu, Jingquan Liu, and Bin Yang
Shanghai Jiao Tong University, CHINA
- 12:40 DEFORMABLE SUPEROLEOPHOBIC SURFACES WITH HIGH MECHANICAL RESILIENCE**
Qingyang Sun and Tingyi “Leo” Liu
University of Massachusetts, Amherst, USA
- 12:55 KIRIGAMI STRUCTURE WITH A LARGE UNIFORM DEFORMATION REGION**
Hiroki Taniyama and Eiji Iwase
Waseda University, JAPAN

Session IIc – Actuators

Session Chair:

Sten Vollebregt, Delft University of Technology, NETHERLANDS

- 12:10 STIFFNESS-TUNABLE MICROSTRUCTURES BASED ON ELECTROTHERMAL BIMORPH BEAMS**
Lei Xiao¹, Yingtao Ding¹, Peng Wang², Hengzhang Yang¹, and Huikai Xie¹
¹Beijing Institute of Technology, CHINA and ²Wuxi WiO Technologies, Co. Ltd., CHINA
- 12:25 MULTI-WAY IN-PHASE/OUT-OF-PHASE DRIVING CANTILEVER ARRAY FOR PERFORMANCE ENHANCEMENT OF PZT MEMS MICROSPEAKER**
Yi-Jia Wang¹, Sung-Cheng Lo¹, Meng-Lin Hsieh¹, Shao-Da Wang¹, Yu-Chen Chen¹, Mingching Wu², and Weileun Fang¹
¹National Tsing Hua University, TAIWAN and ²Coretronic MEMS Co., LTD, TAIWAN
- 12:40 MODELING MATERIAL NONLINEARITIES IN PIEZOELECTRIC FILMS: QUASI-STATIC ACTUATION**
Andrea Opreni¹, Nicolás Boni², Gianluca Mendicino², Massimiliano Merli², Roberto Carminati², and Attilio Frangi¹
¹Politecnico di Milano, ITALY and ²STMicroelectronics, ITALY
- 12:55 DUAL-AXIS RESONANT SCANNING MEMS MIRROR WITH PULSED-LASER-DEPOSITED BARIUM-DOPED PZT**
Adrien Piot, Jaka Pribošek, and Mohssen Moridi
Silicon Austria Labs, AUSTRIA
- 13:10 Adjour for the day**

Day 2 - Tuesday, 26 January

Plenary Speaker Presentation II

Session Chair:

Haixia "Alice" Zhang, Peking University, CHINA

08:00 RECENT ADVANCES IN FLEXIBLE OPTOELECTRONICS

Wei Huang

Northwestern Polytechnical University, CHINA

08:45 – 08:50 Transition Break

Session IIIa – Wearables

Session Chair:

Tiger Tao, Chinese Academy of Sciences (CAS), CHINA

08:50 DESIGN AND FABRICATION OF FLEXIBLE TWO-PHASE HEAT TRANSPORT DEVICE FOR WEARABLE INTERFACES

Kenya Sugimoto, Abdulkareem Alasli, Ai Ueno, and Hosei Nagano

Nagoya University, JAPAN

09:05 A BIOINSPIRED WIRELESS EPIDERMAL PHOTORECEPTOR FOR SMART UV PROTECTION AND PHYSIOLOGICAL MONITORING

Yujia Zhang^{1,2}, Mengwei Liu^{1,2}, and Tiger H. Tao^{1,2,3,4,5}

¹Chinese Academy of Sciences (CAS), CHINA, ²University of Chinese Academy of Sciences, CHINA,

³ShanghaiTech University, CHINA, ⁴Institute of Brain-Intelligence Technology, CHINA, and

⁵Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

09:20 WEARABLE PIEZOELECTRIC THIN-FILM BASED BREATH SENSING DEVICE WITH HIGHLY SENSITIVE AMMONIA DETECTION ABILITY FOR EXAMINING KIDNEY DISEASE

Guo-Hua Feng¹ and Pin-Cheng Su²

¹National Tsing Hua University, TAIWAN and ²National Chung Cheng University, TAIWAN

09:35 SELF-POWERED HYBRID WEARABLE E-SKIN FOR ARTIFICIAL INTELLIGENCE SENSING SYSTEM

Jiayi Yang, Wei Xu, Shuangshuang Liu, Sida Liu, Di Feng, Yan Meng, and Meiqi Wang

Beijing Jiaotong University, CHINA

Session IIIb - Particle Handling

Session Chair:

Karen Cheung, University of British Columbia, CANADA

08:50 ULTRAHIGH RESOLUTION ON-CHIP SEPARATION SYSTEM USING NEGATIVE MAGNETOPHORESIS

Lin Zeng, Xi Chen, Jing Du, Zitong Yu, Rongrong Zhang, Yi Zhang, and Hui Yang

Chinese Academy of Sciences (CAS), CHINA

09:05 CONTINUOUS-FLOW ELECTROKINETIC ENRICHMENT/SEPARATION OF NANOPARTICLES USING 3D MICROELECTRODE TRACKS

Zili Tang, Stanley D. Kushigbor, and Levent Yobas

Hong Kong University of Science and Technology, HONG KONG

- 09:20 ONE-STEP SYNTHESIS OF MAGNETIC HYDROGEL MICROPARTICLES BASED ON ACOUSTIC MICROFLUIDICS**
 Shanbo Jin¹, Ziwei Yang¹, Juan Ren², Zhuangde Jiang¹, and Xueyong Wei¹
¹*Xi'an Jiaotong University, CHINA* and ²*Chang'an University, CHINA*
- 09:35 MAGNETIC FORCE-BASED MICROFLUIDIC CHIP FOR PLANT SEED LEVITATION TO SIMULATE MICROGRAVITY ENVIRONMENT**
 Jing Du, Lin Zeng, Zitong Yu, Xi Chen, Yi Zhang, and Hui Yang
Chinese Academy of Sciences (CAS), CHINA

Session IIIc - Tactile & Pressure Sensors

Session Chair:

Shuji Tanaka, Tohoku University, JAPAN

- 08:50 DEVELOPMENT OF FLEXIBLE HAPTIC DEVICE BASED ON ULTRA-THIN PZT/SILICON VIBRATOR ARRAY**
 Toshihiro Takeshita¹, Takahiro Yamashita¹, Toshiyuki Tsubakimoto², Hidetoshi Nishio², Hiroyuki Okuno², Takuto Ohzawa², and Takeshi Kobayashi¹
¹*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN* and ²*OMRON Corporation, JAPAN*
- 09:05 A BIDIRECTIONAL CMOS MEMS THERMAL WALL SHEAR STRESS SENSOR WITH IMPROVED SENSITIVITY AND LOW POWER CONSUMPTION**
 Xiaoyi Wang^{1,2}, Yifei Guo¹, Xu Zhao², and Wei Xu¹
¹*Shenzhen University, CHINA* and ²*Hong Kong University of Science and Technology, HONG KONG*
- 09:20 A WIRELESS CARDIOVASCULAR PRESSURE SENSOR BASED ON AN IONTRONIC FILM WITH HIGH SENSITIVITY**
 Ming-Xian Cai and Yao-Joe Yang
National Taiwan University, TAIWAN
- 09:35 AN ANTENNA-SHAPED MEMS TACTILE SENSOR WITH ANGLE DETECTION CAPABILITY**
 Hayahide Oka¹, Kyohei Terao¹, Fusao Shimokawa¹, and Hidekuni Takao^{1,2}
¹*Kagawa University, JAPAN* and ²*Japan Science and Technology Agency (JST), JAPAN*

09:50 – 09:55 Transition Break

Flash Poster Presentation I

09:55 - 10:30

Poster Session II

10:30 – 11:30 Presentations are listed by topic category with their assigned number starting on page 31.

11:35 – 11:35 Transition Break

Invited Speaker Presentation IIa

Session Chair:

Silvan Schmid, TU Wien, AUSTRIA

- 11:35 NEAR-ZERO POWER INTEGRATED MICROSYSTEMS FOR THE IoT**
Sungho Kang, Vageeswar Rajaram, Sila Deniz Caliskan, Antea Risso, Zhenyun Qian and **Matteo Rinaldi**
Northeastern University, USA

Invited Speaker Presentation IIb

Session Chair:

Stella Pang, City University of Hong Kong, HONG KONG

- 11:35 BEYOND-MATERIALS FOR SUSTAINABLE POWER GENERATION**
Miso Kim
Korea Research Institute of Standards and Science (KRISS), KOREA

12:05 - 12:10 Transition Break

Session IVa – Resonators

Session Chair:

Azadeh Ansari, Georgia Institute of Technology, USA

- 12:10 ACCELERATING MEMS DESIGN PROCESS THROUGH MACHINE LEARNING FROM PIXELATED BINARY IMAGES**
Ruiqi Guo¹, Renxiao Xu¹, Zekai Wang², Fanping Sui¹, and Liwei Lin¹
¹University of California, Berkeley, USA and ²Wuhan University, CHINA
- 12:25 STANDARD CMOS INTEGRATED ULTRA-COMPACT MICROMECHANICAL OSCILLATING ACTIVE PIXEL ARRAYS**
Kalyani Bhosale¹, Chao-Yu Chen², Ming-Huang Li¹, and Sheng-Shian Li¹
¹National Tsing Hua University, TAIWAN and ²Taiwan Semiconductor Manufacturing Company, TAIWAN
- 12:40 A WIDE RANGE FREQUENCY COHERENT MODULATION CONTROL BASED ON MODAL COUPLING EFFECT IN MEMS RESONATORS**
Kuo Lu¹, Xin Zhou^{1,2}, Qingsong Li^{1,2}, Kai Wu¹, Yongmeng Zhang^{1,2}, Ming Zhuo^{1,2}, Xuezhong Wu^{1,2}, and Dingbang Xiao^{1,2}
¹National University of Defense Technology, CHINA and ²Hunan MEMS Research Center, CHINA
- 12:55 TEMPERATURE COEFFICIENT OF RESONANCE FREQUENCY (TCf) OF β -Ga₂O₃ NANOMECHANICAL RESONATORS**
Xu-Qian Zheng and Philip X.-L. Feng
University of Florida, USA

Session IVb – Microdroplets

Session Chair:

Jaume Esteve, Spanish National Research Council (CSIC), SPAIN

12:10 PROTEIN CRYSTALLIZATION IN MICRODROPLETS WITH THE AID OF ELECTRICALLY INDUCED MICROBUBBLES

Akiho Hirao¹, Naotomo Tottori¹, Maasa Yokomori², Miho Tagawa², Shigeo S. Sugano³, Shinya Sakuma¹, and Yoko Yamanishi¹

¹Kyushu University, JAPAN, ²Nagoya University, JAPAN, and

³National Institute of Advanced Industrial Science and Technology (AIST)

12:25 ACOUSTICALLY DRIVEN DROPLET CENTRIFUGATION ENABLED BY FREQUENCY OPERATIONS BEYOND PHONONIC BANDGAPS

Jingui Qian, Habiba Begum, Renhua Yang, and Joshua E.-Y. Lee

City University of Hong Kong, HONG KONG

12:40 ACOUSTIC VALVE FOR DROPLET MICROFLUIDICS

Xianming Qin, Lei Li, Zhuangde Jiang, and Xueyong Wei

Xi'an Jiaotong University, CHINA

12:55 PHARMACEUTICAL OPTO-ELECTRO SENSING SUTURE MADE OF REGENERATED SILK PROTEIN

Mengwei Liu^{1,2}, Yujia Zhang^{1,2}, Yinbo Peng³, and Tiger H. Tao^{1,2,4,5,6}

¹Chinese Academy of Sciences, CHINA, ²University of Chinese Academy of Sciences, CHINA,

³Shanghai Jiao Tong University School of Medicine, CHINA, ⁴ShanghaiTech University, CHINA,

⁵Institute of Brain-Intelligence Technology, CHINA, and

⁶Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

Session IVc – Accelerometers

Session Chair:

David Elata, Technion - Israel Institute of Technology, ISRAEL

12:10 A MEMS ACCELEROMETER WITH AN AUTO-TUNING SYSTEM BASED ON AN ELECTROSTATIC ANTI-SPRING

Chen Wang^{1,2,3}, Yuan Wang⁴, Weidong Fang¹, Xiaoxiao Song⁴, Aojie Quan³, Michiel Gidts³, Rui Esteves³, Jian Bai¹, Huafeng Liu⁴, and Michael Kraft³

¹Zhejiang University, CHINA, ²University of Liege, BELGIUM, ³University of Leuven, BELGIUM, and

⁴Huazhong University of Science and Technology, CHINA

12:25 STRESS-AND-TEMPERATURE-INDUCED DRIFT COMPENSATION ON A HIGH DYNAMIC RANGE ACCELEROMETER ARRAY USING DEEP NEURAL NETWORKS

Vincent P.J. Chung, Yi-Chung Lin, Xiaoliang Li, Metin G. Guney, Jeyanandh Paramesh, Tamal Mukherjee, and Gary K. Fedder

Carnegie Mellon University, USA

12:40 RESONANT ACCELEROMETERS BASED ON NANOMECHANICAL PIEZORESISTIVE TRANSDUCTION

Théo Miani¹, Thierry Verdot¹, Audrey Berthelot¹, Federico Maspero³, Alexandra Koumela¹, Philippe Robert¹, Giacomo Langfelder², Julien Arcamone¹, and Marc Sansa¹

¹CEA-Leti, FRANCE, ²Politecnico di Milano, ITALY, and ³CNR-Istituto di Fotonica e Nanotecnologie, ITALY

12:55 A MEMS VIBRATING BEAM ACCELEROMETER FOR HIGH RESOLUTION SEISMOMETRY AND GRAVIMETRY

Guillermo Sobreviela-Falces^{1,2}, Milind Pandit^{1,2}, Arif Mustafazade^{1,2}, Chun Zhao¹, Callisto Pili², Colin Baker², and Ashwin Seshia^{1,2}

¹University of Cambridge, UK and ²Silicon Microgravity Ltd., UK

13:10 Adjourn for the day

Day 3 - Wednesday, 27 January

Plenary Speaker Presentation III

Session Chair:

Philip Feng, University of Florida, USA

08:00 MICROELECTROMECHANICAL SYSTEMS IN THE QUANTUM LIMIT

Andrew N. Cleland

University of Chicago, USA

08:45 – 08:50 Transition Break

Session Va - GHz Acoustic Resonators

Session Chair:

Dana Weinstein, Purdue university, USA

08:50 ALUMINUM NITRIDE COMBINED OVERTONE RESONATOR FOR MILLIMETER WAVE 5G APPLICATIONS

Meruyert Assylbekova¹, Guofeng Chen², Michele Pirro¹, Giuseppe Michetti¹, and Matteo Rinaldi¹

¹Northeastern University, USA and ²Skyworks Solutions, Inc, USA

09:05 PHONON DIFFRACTION LIMITED PERFORMANCE OF FABRY-PÉROT CAVITIES IN PIEZOELECTRIC EPI – HBARS

Vikrant J. Gokhale, Brian P. Downey, D. Scott Katzer, and David J. Meyer

US Naval Research Laboratory, USA

09:20 X-BAND AOM ON CHIP

Hao Tian¹, Junqiu Liu², Anat Siddharth², Terence Blésin², Tobias J. Kippenberg², and Sunil A. Bhave¹

¹Purdue University, USA and ²École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

09:35 THERMAL CHARACTERIZATION OF FERROELECTRIC ALUMINUM SCANDIUM NITRIDE ACOUSTIC RESONATORS

Jialin Wang, Mingyo Park, and Azadeh Ansari

Georgia Institute of Technology, USA

Session Vb - Microfluidic Control /Organ on Chip

Session Chair:

Regina Luttge, Eindhoven University of Technology, NETHERLANDS

08:50 TRANSISTOR OFF-VALVE BASED FEEDBACK, METERING AND LOGIC OPERATIONS IN CAPILLARY MICROFLUIDICS

Claude Meffan, Julian Menges, Fabian Dolamore, Conan Fee, RenWICK Dobson, and Volker Nock

University of Canterbury, NEW ZEALAND

09:05 "BEND-AND-BOND" POLYMER MICROFLUIDIC ORIGAMI

Weijin Guo^{1,2}, Jonas Hansson¹, Linnea Gustafsson¹, and Wouter van der Wijngaart¹

¹KTH Royal Institute of Technology, SWEDEN and ²Shantou University, CHINA

09:20 FABRICATION AND CHARACTERIZATION OF 3D MICROELECTRODE ARRAYS (3D MEAS) WITH "EDGE-WRAPPED" METAL INTERCONNECTS AND 3D-PRINTED ASSEMBLY RIGS FOR SIMULTANEOUS OPTICAL AND ELECTRICAL PROBING OF NERVE-ON-A-CHIP® CONSTRUCTS

Charles M. Didier¹, Corey Rountree², Julia Freitas Orrico¹, Avra Kundu¹, Nilab Azim¹, Hieu Nguyen², Syed K. Pasha¹, Laurie McCoy², J. Lowry Curley², Michael J. Moore^{2,3}, and Swaminathan Rajaraman¹

¹University of Central Florida, USA, ²AxoSim Inc., USA, and ³Tulane University, USA

- 09:35 SHAPE RETAINING AND SACRIFICIAL MOLDING FABRICATION METHOD FOR ECM-BASED IN VITRO VASCULAR MODEL**
Jumpei Muramatsu¹, Wei Huang Goh², Azusa Shimizu¹, Kenya Hashimoto¹, Michinao Hashimoto², Shigenori Miura³, and Hiroaki Onoe¹
¹Keio University, JAPAN, ²Singapore University of Technology and Design, SINGAPORE, and ³University of Tokyo, JAPAN

Session Vc - Energy Harvesting

Session Chair:

Takeshi Kobayashi, National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

- 08:50 CYLINDRICAL ELECTRET ENERGY HARVESTER WITH PERFORATED ELECTRODE FOR INTRACARDIAC PACEMAKERS**
Wei-De Wang, Chia-Chun Hsieh, and Yi Chiu
National Chiao Tung University, TAIWAN
- 09:05 ENHANCING THE OUTPUT CHARGE DENSITY OF TRIBOELECTRIC NANOGENERATOR VIA BUILDING CHARGE BLOCKING LAYER**
Lingxiao Gao, Xin Chen, Fayang Wang, Daqiao Tong, Xianming He, and Xiaojing Mu
Chongqing University, CHINA
- 09:20 PIEZOELECTRIC TANTALUM ALUMINUM NITRIDE FILMS FOR VIBRATIONAL MICRO ENERGY HARVESTERS**
Le Van Minh and Hiroki Kuwano
Tohoku University, JAPAN
- 09:35 MICROMACHINED FLEXIBLE SEMI-TRANSPARENT SILICON SOLAR CELLS AS POWER SOURCES FOR MICROSYSTEMS**
Erfan Pourshaban, Aishwaryadev Banerjee, Chayanjit Ghosh, Adwait Deshpande, Hanseup Kim, and Carlos H. Mastrangelo
University of Utah, USA

09:50 – 09:55 Transition Break

Flash Poster Presentation I

09:55 - 10:30

Poster Session III

10:30 – 11:30 Presentations are listed by topic category with their assigned number starting on page 31.

11:35 – 11:35 Transition Break

Invited Speaker Presentation IIIa

Session Chair:

Zhihong Li, Peking University, CHINA

- 11:35 IMPLANTABLE BRAIN COMPUTER INTERFACE DEVICES BASED ON MEMS TECHNOLOGY**
Long-Chun Wang, Zhe-Jun Guo, Ye Xi, Ming-Hao Wang, Bo-Wen Ji, Hong-Chang Tian, Xiao-Yang Kang, and **Jing-Quan Liu**
Shanghai Jiao Tong University, CHINA

Invited Speaker Presentation IIIb

Session Chair:

Valentina Zega, Politecnico di Milano, ITALY

11:35 MEMS-ENABLED QUANTUM ATOMIC MAGNETOMETERS

Sean Krzyzewski¹, Orang Alem^{1,2}, and **Svenja A. Knappe**^{1,2}

¹University of Colorado, Boulder, USA and ²FieldLine Inc., USA

12:05 - 12:10 Transition Break

Session VIa - Bio Electrodes

Session Chair:

Swaminathan Rajaraman, University of Central Florida, USA

12:10 AN ULTRA-CONFORMABLE HIGHLY ENRICHED DISTRIBUTED BRAIN ELECTRODE

Feihong Xu^{1,2}, Zhitao Zhou^{1,2}, Haoyuan Li³, and Tiger H. Tao^{1,2}

¹Chinese Academy of Sciences (CAS), CHINA, ²University of Chinese Academy of Sciences, CHINA, and ³Fudan University, CHINA

12:25 ULTRA-FLEXIBLE, HIGH-DENSITY NEURAL ELECTRODE PROBES FOR RELIABLE MULTI-REGION NEURAL ACTIVITY MONITORING

Yu Zhou^{1,2}, Zhitao Zhou¹, Haoyuan Li³, Huiran Yang¹, Xueying Wang^{1,2}, Zhifeng Shi³, Ying Mao³, Tiger H. Tao^{1,2}, and Xiaoling Wei^{1,2}

¹Chinese Academy of Sciences (CAS), CHINA, ²University of Chinese Academy of Sciences, CHINA, and ³Fudan University, CHINA

12:40 FLEXIBLE CONCENTRIC RING ELECTRODE ARRAY FOR LOW-NOISE AND NON-INVASIVE DETECTION

Zhongke Mei, Nan Zhao, Bin Yang, and Jingquan Liu
Shanghai Jiao Tong University, CHINA

12:55 ANNULAR MICRO-NEEDLE ARRAY AS A MINIMALLY INVASIVE FLEXIBLE DRY ELECTRODE FOR ON-HAIR EEG RECORDING

Junshi Li, Zhitong Zhang, Zhongyan Wang, Yingjie Ren, Dong Huang, Qining Wang, and Zhihong Li
Peking University, CHINA

Session VIb - Thermal & Gas Sensors

Session Chair:

Chander Shekhar Sharma, Indian Institute of Technology Ropar, INDIA

12:10 PRINTED POLYMER COMPOSITE SENSORS FOR LOW-POWER, NEAR ROOM-TEMPERATURE DETECTION AND CLASSIFICATION OF VOCs

Mohammad Mahdi Kiaee, Thomas Maeder, and Juergen Brugger
École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

12:25 A POLARIZATION-SENSITIVE PHOTODETECTOR BASED ON 3D MICROTUBULAR GRAPHENE FIELD-EFFECT TRANSISTOR

Yang Zhang, Ke Li, Jingye Sun, Mingqiang Zhu, Jincheng Li, and Tao Deng
Beijing Jiaotong University, CHINA

12:40 INFRARED THERMOPILE SENSORS WITH IN-SITU INTEGRATION OF COMPOSITE NANOFORESTS FOR ENHANCED OPTICAL ABSORPTION

Meng Shi¹, Xin Dai², Yang Liu¹, Na Zhou¹, Chenchen Zhang¹, Yue Ni², Haiyang Mao¹, and Dapeng Chen¹
¹Chinese Academy of Sciences (CAS), CHINA and ²Jiangsu Hinovaic Technologies Co., Ltd, CHINA

- 12:55 A NEW SCHEME TO ENHANCE/DECREASE SENSITIVITY OF A MEMS RESONATOR USING PARAMETRIC MODULATION**
Chengxin Li¹, Jingqian Xi¹, Yuan Wang¹, Fangzheng Li¹, Lu Gao¹, Huafeng Liu¹, Chun Zhao¹,
and Liangcheng Tu^{1,2}
¹Huazhong University of Science and Technology, CHINA and ²Sun Yat-sen University, CHINA

Session VIc - Optical MEMS

Session Chair:

Niels Quack, École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

- 12:10 DESIGN AND FABRICATION OF A FORWARD VIEW SCANNER ON SIOB WITH LATCH STRUCTURE FOR IMPROVED VERTICAL ORIENTATION**
Dingkang Wang¹, Dong Zheng¹, Sanjeev Koppal¹, Boqian Sun², and Huikai Xie²
¹University of Florida, USA and ²Beijing Institute of Technology, CHINA
- 12:25 A HIGH-FREQUENCY TUNABLE PIEZOELECTRIC MEMS SCANNER FOR FAST ADDRESSING APPLICATIONS**
Paul Janin, Ralf Bauer, Paul Griffin, Erling Riis, and Deepak Uttamchandani
University of Strathclyde, UK
- 12:40 LOW-VOLTAGE SILICON PHOTONIC MEMS SWITCH WITH VERTICAL ACTUATION**
Hamed Sattari¹, Alain Y. Takabayashi¹, Pierre Edinger², Peter Verheyen³, Kristinn B. Gylfason²,
Wim Bogaerts^{3,4}, and Niels Quack¹
¹École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND,
²KTH Royal Institute of Technology, SWEDEN, ³IMEC, BELGIUM, and ⁴Ghent University, BELGIUM
- 12:55 SUBWAVELENGTH-ENGINEERED SUSPENDED SILICON WAVEGUIDE FOR LONG-WAVE INFRARED SENSING APPLICATIONS**
Weixin Liu, Yiming Ma, Yuhua Chang, Bowei Dong, Jingxuan Wei, and Chengkuo Lee
National University of Singapore, SINGAPORE
- 13:10** Adjourn for the day

Day 4 - Thursday, 28 January

Plenary Speaker Presentation IV

Session Chair:

Niclas Roxhed, KTH Royal Institute of Technology, SWEDEN

08:00 EXPLORING SYNERGY BETWEEN DRUG DELIVERY AND MEMS

Anja Boisen

Technical University of Denmark, DENMARK

MEMS 2022 Announcement

09:00 - 09:05 Transition Break

Session VIIa - Biomarker Detection

Session Chair:

Beomjoon Kim, University of Tokyo, JAPAN

09:05 DETECTION OF METHYLATED CELL-FREE DNA FOR DIAGNOSIS AND PROGNOSIS OF OVARIAN CANCER ON AN INTEGRATED MICROFLUIDIC SYSTEM

Yu-Jen Cheng, Chih-Hung Wang, and Gwo-Bin Lee

National Tsing Hua University, TAIWAN

09:20 HIGH-ENTROPY ALLOY NANOPARTICLES AS CATALYST FOR NANOMOLAR-LEVEL DETECTION OF NEUROTRANSMITTER SEROTONIN IN SERUM

Ming Li^{1,2}, Xuefeng Wang^{1,2}, Yarong Cheng^{1,3}, Li Su^{1,3}, Pengcheng Xu^{1,2}, and Xinxin Li^{1,2}

¹Chinese Academy of Sciences (CAS), CHINA, ²University of Chinese Academy of Sciences, CHINA, and

³Shanghai Normal University, CHINA

09:35 AN INTEGRATED MICROFLUIDIC SYSTEM FOR EARLY DIASNOSIS OF BREAST CANCER IN LIQUID BIOPSY BY USING MICRORNA AND FET BIOSENSORS

Chi-Chien Huang, Yu-Husan Kuo, Yi-Sin Chen, and Gwo-Bin Lee

National Tsing Hua University, TAIWAN

Session VIIb: Humidity Sensors

Session Chair:

Bonnie Gray, Simon Fraser University, CANADA

09:05 HIGHLY SENSITIVE AND FAST-RESPONSE HUMIDITY SENSOR BASED ON SAW RESONATOR AND MoS₂ FOR HUMAN ACTIVITY DETECTION

Hanyong Dong, Dongsheng Li, Jintao Pang, Qian Zhang, and Jin Xie

Zhejiang University, CHINA

09:20 MICROMACHINED SILICON CANTILEVER RESONATOR-BASED HUMIDITY SENSORS FOR MULTIFUNCTIONAL APPLICATIONS

Jiushuai Xu and Erwin Peiner

Technische Universität Braunschweig, GERMANY

09:35 A HIGHLY SENSITIVE HUMIDITY SENSOR BASED ON NANOFORESTS

Guidong Chen^{1,2}, Xin Dai³, Yang Liu^{1,2}, Haiyang Mao^{1,2,3}, and Dapeng Chen^{1,2}

¹Chinese Academy of Sciences (CAS), CHINA, ²University of Chinese Academy of Sciences, CHINA and

³Jiangsu Hinovaic Technologies Co., Ltd, CHINA

Session VIIc: Gyroscopes

Session Chair:

Zheyao Wang, Tsinghua University, CHINA

09:05 AN ANTI-ALIASING AND SELF-CLOCKING $\Sigma\Delta$ M COBWEB-LIKE DISK RESONANT GYROSCOPE WITH EXTENDED INPUT RANGE

Fang Chen¹, Zuxiang Wen², Dacheng Xu², Wei Zhou¹, and Xinxin Li¹

¹Chinese Academy of Sciences (CAS), CHINA and ²Soochow University, CHINA

09:20 DESIGN OF PIEZOELECTRIC MEMS BULK ACOUSTIC WAVE MODE-MATCHED GYROSCOPES BASED ON SUPPORT TRANSDUCER

Ngoc Minh Nguyen, Chin-Yu Chang, Gayathri Pillai, and Sheng-Shian Li

National Tsing Hua University, TAIWAN

09:35 A STUDY OF MODE-MATCHING AND ALIGNMENT IN PIEZOELECTRIC DISK RESONATOR GYROS VIA FEMTOSECOND LASER ABLATION

Zhenming Liu, Anosh Daruwalla, Benoit Hamelin, and Farrokh Ayazi

Georgia Institute of Technology, USA

09:50 – 09:55 Transition Break

Flash Poster Presentation I

09:55 - 10:30

Poster Session IV

10:30 – 11:30 Presentations are listed by topic category with their assigned number starting on page 31.

11:35 – 11:35 Transition Break

Invited Speaker Presentation IVa

Session Chair:

Haluk Külâh, Middle East Technical University (METU), TURKEY

11:35 DEVELOP MICRO/NANO TECHNOLOGIES FOR CANCER DIAGNOSIS

Si-Yang Zheng

Carnegie Mellon University, USA

Invited Speaker Presentation IVb

Session Chair:

Eun Kim, University of Southern California, USA

11:35 IoT4Ag: MEMS-ENABLED DISTRIBUTED SENSING, COMMUNICATIONS, AND INFORMATION SYSTEMS FOR THE INTERNET OF THINGS FOR PRECISION AGRICULTURE

Cherie R. Kagan¹, David P. Arnold², Mark G. Allen¹, and Roy H. Olsson¹

¹University of Pennsylvania, USA and ²University of Florida, USA

12:05 - 12:10 Transition Break

Session VIIIa - DNA/RNA Sensing

Session Chair:

Euisik Yoon, University of Michigan, USA

- 12:10 SAPPHIRE-SUPPORTED NANOPORES FOR LOW-NOISE DNA SENSING**
Pengkun Xia, Jiawei Zuo, Shinhyuk Choi, Xiahui Chen, Jing Bai, and Chao Wang
Arizona State University, USA
- 12:25 HIGHLY SENSITIVE AND HIGHLY MULTIPLEXED CELL-FREE DNA GENOTYPING USING 7.7X10⁴-WELL DIGITAL PCR WITH MELTING CURVE ANALYSIS**
Tatsuo Nakagawa, Junko Tanaka, Kazuma Matsui, Kunio Harada, Akiko Shiratori, and Chihiro Uematsu
Hitachi, Ltd., JAPAN
- 12:40 A HIGH-THROUGHPUT NANOFUIDIC DEVICE FOR SMALL EXTRACELLULAR VESICLE NANOPORATION**
Rui Hao¹, Zitong Yu¹, Jing Du¹, Hang Guo², Yi Zhang¹, and Hui Yang¹
¹*Chinese Academy of Sciences (CAS), CHINA* and ²*Xiamen University, CHINA*
- 12:55 EXTRACTION AND QUANTIFICATION OF MICRORNA BIOMARKERS FOR DIAGNOSIS OF OVARIAN CANCER ON AN INTEGRATED MICROFLUIDIC PLATFORM**
Chia-Yu Sung, Chi-Chien Huang, Yi-Sin Chen, and Gwo-Bin Lee
National Tsing Hua University, TAIWAN

Session VIIIb - MEMS for Harsh Environment

Session Chair:

Cristian Cassella, Northeastern University, USA

- 12:10 WAFER-SCALE ENCAPSULATED SAW TEMPERATURE AND PRESSURE SENSORS FOR HARSH ENVIRONMENTS**
Eldwin J. Ng¹, Jaibir Sharma¹, Eva Wai Leong Ching¹, Guoqiang Wu¹, Didier Pohl², and Olivier Vancauwenberghe²
¹*Agency for Science, Technology and Research (A*STAR), SINGAPORE* and ²*Safran Tech, FRANCE*
- 12:25 MEMS MAGNETOMETER USING MAGNETIC FLUX CONCENTRATORS AND PERMANENT MAGNETS**
Federico Maspero¹, Gabriele Gatani³, Simone Cuccurullo², and Riccardo Bertacco^{1,2}
¹*CNR-Istituto di Fotonica e Nanotecnologie, ITALY*, ²*Politecnico di Milano, ITALY*, and ³*Politecnico di Torino, ITALY*
- 12:40 THE DESIGN AND FABRICATION OF THE HIGH INTEGRATED SENSITIVE ELECTRODES BY ADOPTING THE ANODIC BONDING TECHNOLOGY FOR THE ELECTROCHEMICAL SEISMIC SENSORS**
Chao Xu^{1,2}, Junbo Wang¹, Deyong Chen¹, Jian Chen¹, Wenjie Qi^{1,2}, Bowen Liu^{1,2}, Xu She^{1,2}, and Tian Liang^{1,2}
¹*Chinese Academy of Sciences (CAS), CHINA* and ²*University of Chinese Academy of Sciences, CHINA*
- 12:55 OPTICAL FIBER-TIP PRESSURE SENSOR FEATURING A SPRING BODY AND MULTIPOSITIONAL FABRY-PÉROT CAVITY RESONATOR**
Jeremiah C. Williams¹, Joseph S. Suelzer², Nicholas G. Usechak², and Hengky Chandrahilim¹
¹*U.S. Air Force Institute of Technology, USA* and ²*Air Force Research Laboratory, USA*

Session VIIIc - Ultrasonic Transducers

Session Chair:

Liviu Nicu, CNRS, FRANCE

- 12:10 3D ULTRASONIC OBJECT DETECTIONS WITH >1 METER RANGE**
Zhichun Shao, Yande Peng, Sedat Pala, Yue Liang, and Liwei Lin
University of California, Berkeley, USA
- 12:25 IMPROVED RING-DOWN TIME AND AXIAL RESOLUTION OF PMUTS VIA A PHASE-SHIFT EXCITATION SCHEME**
Sedat Pala, Zhichun Shao, Yande Peng, and Liwei Lin
University of California, Berkeley, USA
- 12:40 MONOLITHIC PMUT-ON-CMOS ULTRASOUND SYSTEM FOR SINGLE PIXEL ACOUSTIC IMAGING**
Eyglis Ledesma, Iván Zamora, Arantxa Uranga, and Núria Barniol
Universitat Autònoma de Barcelona, SPAIN
- 12:55 HYDROGEN SELECTIVE GAS SENSOR BASED ON ATTENUATION MEASUREMENT OF ACOUSTIC WAVE USING UNCOATED CMUT**
Luis Iglesias Hernandez¹, Priyadarshini Shanmugam², Jean-François Michaud², Daniel Alquier²,
Dominique Certon², and Isabelle Dufour¹
¹Université de Bordeaux, FRANCE and ²Université de Tours, FRANCE
- 13:10 Adjourn for the day**

Day 5 - Friday, 29 January

Plenary Speaker Presentation V

Session Chair:

Philip Feng, University of Florida, USA

08:00 BERKELEY LIGHTS: MEMS TECHNOLOGY TO ENABLE A SCALABLE AND SUSTAINABLE CELL-BASED FUTURE

Eric D. Hobbs

Berkeley Lights, Inc., USA

08:45 – 08:50 Transition Break

Session IXa - Organ on Chip

Session Chair:

Francesca Santoro, Instituto Italiano di Tecnologia, ITALY

08:50 THREE-DIMENSIONAL MICROFLUIDIC DRUG SCREENING PLATFORM TO STUDY VASCULARIZED HEPATOCELLULAR CARCINOMA IN HYPOXIC CONDITION

Jungeun Lim, Hyeri Choi, and Noo Li Jeon

Seoul National University, KOREA

09:05 ENGINEERING MICROSCALE BIOMIMETIC HYDROSCAFFOLD FOR DYNAMIC THREE-DIMENSIONAL MODELING OF PANCREATIC CANCER

Frédéric De Miollis^{1,2}, Zied Souguir³, Charles Poiraud², Joseph de Saxcé², Lucie Dercourt¹,

Elodie Vandenhoute³, Audrey Vincent², Nathalie Maubon³, Isabelle Van Seuning², and Vincent Senez¹

¹CNRS, FRANCE, ²University of Lille, FRANCE, and ³HCS Pharma, FRANCE

09:20 HIGHLY ACCURATE MEASUREMENT OF TRANS-EPITHELIAL ELECTRICAL RESISTANCE IN ORGAN-ON-A-CHIP

Takashi Miyazaki¹, Jiandong Yang¹, Satoshi Imamura¹, Yoshikazu Hirai¹, Ken-ichiro Kamei¹,

Toshiyuki Tsuchiya¹, and Osamu Tabata^{1,2}

¹Kyoto University, JAPAN and ²Kyoto University of Advanced Science, JAPAN

09:35 EVALUATION OF TRANS-EPITHELIAL ELECTRICAL RESISTANCE OF PROXIMAL TUBULE TISSUE BY INCLUSION AND REMOVAL OF EXTRACELLULAR CALCIUM ION

Yuji Takata¹, Ryohei Ueno¹, Ramin Banan Sadeghian¹, Kaori Naganuma², Kiyotaka Tsuji²,

and Ryuji Yokokawa¹

¹Kyoto University, JAPAN and ²Panasonic Corporation, JAPAN

Session IXb - PMUT Sensors

Session Chair:

David Horsley, University of California, Davis, USA

08:50 A PMUT-BASED ULTRASONIC PROBE USED FOR CONTACT FORCE SENSING

Tingzhong Xu, Libo Zhao, Zixuan Li, Jiawei Yuan, Yihe Zhao, Guoxi Luo, Jie Li, Zhiakang Li, Ping Yang, and Zhuangde Jiang

Xi'an Jiaotong University, CHINA

09:05 PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCERS FOR BLOOD VESSEL MOTION TRACKING

Xiaoyue (Joy) Jiang¹, Vincent Perrot^{2,3}, François Varray², Mei-Lin Chan¹, Bala Govind¹, Stephen Bart¹, and Peter Hartwell¹

¹TDK InvenSense, USA, ²University Lyon, FRANCE, and ³Polytechnique Montréal, CANADA

09:20 AIN BASED PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCERS FOR CONTINUOUS MONITORING OF THE MECHANO-ACOUSTIC CARDIOPULMONARY SIGNALS

Licheng Jia, Lei Shi, Chengliang Sun, Sheng Liu, and Guoqiang Wu
Wuhan University, CHINA

Session IXc - Gas Sensors

Session Chair:

Hyunjoo Jenny Lee, Korea Advanced Institute of Science and Technology (KAIST), KOREA

08:50 A NOVEL LOW POWER HEXAGONAL GAS SENSOR CELL FOR MULTI-CHANNEL GAS DETECTION

Dongcheng Xie, Ruichen Liu, George Adedokun, Lei Xu, and Feng Wu
University of Science and Technology of China, CHINA

09:05 PLANAR LAB-ON-A-CHIP MICRO MASS SPECTROMETER WITH TIME-OF-FLIGHT SEPARATION

Stephan Westerdick, Bent Walther, Patrick Hermanns, Florian Fricke, and Thomas Musch
Ruhr University Bochum, GERMANY

09:20 RAPID GAS SENSING BASED ON PULSE HEATING AND DEEP LEARNING

Yushen Hu, Ye Tian, Yi Zhuang, Changhui Zhao, and Fei Wang
Southern University of Science and Technology, CHINA

09:35 A HIGH RESPONSE THREE-DIMENSIONAL Ag NANOPARTICLES/RGO MICROTUBULAR FIELD EFFECT TRANSISTOR SENSOR FOR NO₂ DETECTIONS

Jingye Sun¹, Weijie Yin¹, Ying Zhang¹, Yang Zhang¹, Mingqiang Zhu¹, Hao Hong², Qiming Tian³, Juntao Qi³, Yutao Ba³, and Tao Deng¹
¹Beijing Jiaotong University, CHINA, ²Tsinghua University, CHINA, and ³Insights Value Technology, CHINA

09:50 – 09:55 Transition Break

Flash Poster Presentation I

09:55 - 10:30

Poster Session V

10:30 – 11:30 Presentations are listed by topic category with their assigned number starting on page 31.

11:35 – 11:35 Transition Break

Invited Speaker Presentation Va

Session Chair:

Carolyn Ren, University of Waterloo, CANADA

11:35 WHAT DOES A CELL SECRETE? ON-CHIP ANALYSIS OF COMPOUNDS AND VESICLES RELEASED FROM SINGLE CELLS

Petra S. Dittrich
ETH Zurich, Basel, SWITZERLAND

Invited Speaker Presentation Vb

Session Chair:

Hanna Cho, Ohio State University, USA

11:35 THIN FILM DEVICES FOR 5G COMMUNICATIONS

Soumya Yandrapalli, Marco Liffredo, Muhammad Faizan, Seniz Küçük, Damien Maillard,
and **Luis Guillermo Villanueva**

École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

12:05 – 12:10 Transition Break

Session Xa - Cell Handling/Analysis

Session Chair:

Jungyul Park, Sogang University, KOREA

12:10 REAL-TIME THREE-DIMENSIONAL SINGLE-CELL-RESOLUTION MONITORING SYSTEM FOR OBSERVATION OF DYNAMIC CELL BEHAVIOR UNDER MECHANICAL STIMULI

Keitaro Kasahara¹, Yuta Kurashina², Shigenori Miura³, Shogo Miyata¹, and Hiroaki Onoe¹

¹Keio University, JAPAN, ²Tokyo Institute of Technology, JAPAN, and ³University of Tokyo, JAPAN

12:25 OXYGEN-TRANSPORTING PARYLENE-HT MESH FOR CELL TRANSPLANTATION TO REDUCE HYPOXIA

Kuang-Ming Shang¹, Hirotake Komatsu², and Yu-Chong Tai¹

¹California Institute of Technology, USA and ²Beckman Research Institute of City of Hope, USA

12:40 FEMTOSECOND LASER-INDUCED RESPONSE WAVE MEASURING METHOD FOR SINGLE CELL CHARACTERIZATION

Tang Tao¹, Yansheng Hao¹, Yo Tanaka², Yoichiro Hosokawa¹, and Yalikun Yaxiaer¹

¹Nara Institute of Science and Technology, JAPAN and

²Institute of Physical and Chemical Research (RIKEN), JAPAN

Session Xb - LiNbO₃ and WBG Resonators

Session Chair:

Pierre Blondy, XLIM, FRANCE

12:10 LITHIUM NIOBATE THIN FILM BASED A3 MODE RESONATORS WITH HIGH EFFECTIVE COUPLING COEFFICIENT OF 6.72%

Yi Zhang¹, Liang Wang², Yang Zou¹, Qinwen Xu¹, Jieyu Liu¹, Qing Wang², Alexander Tovstopyat¹,
Wenjuan Liu¹, Chengliang Sun¹, and Hongyu Yu^{2,3,4}

¹Wuhan University, CHINA, ²Southern University of Science and Technology, CHINA,

³Shenzhen Institute of Wide-bandgap Semiconductors, CHINA, and ⁴Ministry of Education, CHINA

12:25 A THIN-FILM PIEZO-SILICON ACOUSTOELECTRIC ISOLATOR WITH MORE THAN 30 DB NON-RECIPROCAL TRANSMISSION

Hakhamanesh Mansoorzare and Reza Abdolvand

University of Central Florida, USA

12:40 LOW LOSS AND WIDEBAND SURFACE ACOUSTIC WAVE DEVICES IN THIN FILM LITHIUM NIOBATE ON INSULATOR (LNOI) PLATFORM

Tzu-Hsuan Hsu, Feng-Chieh Su, Kuan-Ju Tseng, and Ming-Huang Li

National Tsing Hua University, TAIWAN

12:55 TEMPERATURE DEPENDENCE OF MULTIMODE GALLIUM NITRIDE/ALUMINUM NITRIDE (GaN/AlN) HETEROSTRUCTURE STRING RESONATOR

Wen Sui¹, Xu-Qian Zheng¹, Ji-Tzuoh Lin², Bruce W. Alphenaar², and Philip X.-L. Feng¹

¹University of Florida, USA and ²University of Louisville, USA

Award Ceremony

13:10 Outstanding Paper Award

13:40 Conference Adjourns

POSTER PRESENTATIONS

M	– Monday, 25 January	10:30 - 11:30	Th	– Thursday, 28 January	10:30 - 11:30
T	– Tuesday, 26 January	10:30 - 11:30	F	– Friday, 29 January	10:30 - 11:30
W	– Wednesday, 27 January	10:30 - 11:30			

Classification Chart
(last character of poster number)

a	Bio & Medical MEMS
b	Emerging Technologies & New Opportunities for MEMS/NEMS
c	Materials, Fabrication and Packaging for Generic MEMS & NEMS
d	MEMS Actuators & Power MEMS
e	MEMS Physical & Chemical Sensors
f	MEMS/NEMS for Optical, RF and Electromagnetics
g	Micro- & Nanofluidics
h	Industry MEMS and Advancing MEMS for Products and Sustainability
i	Open Posters

a - Bio & Medical MEMS
Biosensors and Bioreactors

M-101.a FLEXIBLE MULTIVARIABLE SENSOR BASED ON MXENE AND LASER-INDUCED GRAPHENE FOR DETECTIONS OF VOLATILE ORGANIC COMPOUNDS IN EXHALED BREATH

Dongsheng Li, Mengjiao Qu, Qian Zhang, and Jin Xie
Zhejiang University, CHINA

T-201.a TWO-Dimensionally Arrayed Double-Layer Electrode Device Which Enables Reliable and High-Thoroughput Electrorotation

Taku Tsuchiya¹, Yuki Okamoto^{1,2}, Frédéric Marty³, Ayako Mizushima¹, Agnès Tixier-Mita¹, Olivier Français³, Bruno Le Pioufle⁴, and Yoshio Mita¹
¹University of Tokyo, JAPAN, ²National Institute of Advanced Industrial Science and Technology (AIST), JAPAN, ³ESIEE Paris Université Paris-Est, FRANCE, and ⁴ENS Paris-Saclay, FRANCE

a - Bio & Medical MEMS
Devices & Systems for Cellular and Molecular Studies

W-301.a A 3D-PRINTED ELECTRICAL IMPEDANCE FLOW CYTOMETER ARRAY FOR PARALLEL DETECTION OF CELLULAR BIOMARKERS

Chenguang Zhou, Mu Chen, Dezhi Tang, and Yu Han
Southeast University, CHINA

Th-401.a DEVELOPING A MEMS DEVICE FOR HIGH-THROUGHPUT MULTI-PARAMETER SINGLE CELL BIOPHYSICAL ANALYSIS

Quentin Rezard^{1,2}, Grégoire Perret^{2,3}, Jean Claude Gerbedoen^{2,3}, Deniz Pekin^{2,4}, Fabrizio Cleri¹, Dominique Collard^{2,3}, Chann Lagadec^{2,5}, and Mehmet C. Tarhan^{1,2}

¹CNRS, FRANCE, ²CNRS, IIS, FRANCE, ³LIMMS/CNRS-IIS, FRANCE, and ⁴INSERM, FRANCE, and ⁵CANTHER, FRANCE

F-501.a ELECTRICAL FIELD CHAMBER WITH DINAMICALLY ADAPTABLE STIMULI FOR MYOCYTE ORIENTATION DURING CULTIVATION

Sergio R. Molina Ramirez, Takahiro Yamada, Akira Funahashi, and Hiroaki Onoe
Keio University, JAPAN

M-102.a GOLD-POLYSTYRENE CORE-SHELL HYBRID NANOPARTICLES MEDIATED HIGHLY EFFICIENT INTRACELLULAR DELIVERY USING LIGHT PULSES

Kavitha Illath¹, Srabani Kar², Syrpailyn Wankhar³, Moeto Nagai⁴, Fan-Gang Tseng⁵, and Tuhin Subhra Santra¹

¹Indian Institute of Technology, Madras, INDIA, ²University of Cambridge, UK, and

³Christian Medical College Vellore, INDIA, ⁴Toyohashi University of Technology, JAPAN,

⁵National Tsing Hua University, TAIWAN

T-202.a MEA-ON-CANTILEVER – A NOVEL MULTIFUNCTIONAL DEVICE FOR DRUG TOXICITY SCREENING IN CARDIOMYOCYTES

Pooja P. Kanade, Nomin-Erdene Oyunbaatar, Yun-Jin Jeong, and Dong-Weon Lee
Chonnam National University, KOREA

W-302.a PROXIMAL TUBULE ON A CHIP FOR EVALUATING P-GLYCOPROTEIN TRANSPORT PROPERTY

Akihiko Kawakami¹, Ryohei Ueno¹, Ramin Banan Sadeghian¹, Toshikazu Araoka², Jun Yamashita², Minoru Takasato³, and Ryuji Yokokawa¹

¹Kyoto University, JAPAN, ²Center for iPS Cell Research & Application, JAPAN, and

³Institute of Physical and Chemical Research (RIKEN), JAPAN

Th-402.a TRAVERSING BEHAVIOR OF NASOPHARYNGEAL EPITHELIAL AND CARCINOMA CELLS ON TWO-LAYER SCAFFOLD PLATFORMS

M.T. Wang and Stella W. Pang
City University of Hong Kong, HONG KONG

a - Bio & Medical MEMS

Flexible and Wearable Devices and Systems

F-502.a A MULTIMODAL SELF-HEALING FLEXIBLE SWEAT SENSOR FOR HEALTHCARE MONITORING

Peisheng He, Yande Peng, and Liwei Lin
University of California, Berkeley, USA

M-103.a GRAPHENE-ON-POLYMER FLEXIBLE VAPORIZABLE SENSOR

Ved Gund and Amit Lal
Cornell University, USA

T-203.a HIGHLY DEFORMABLE AND TRANSPARENT TRIBOELECTRIC PHYSIOLOGICAL SENSOR BASED ON ANTI-FREEZING AND ANTI-DRYING IONIC CONDUCTIVE HYDROGEL

Zhensheng Chen¹, Jiahao Yu¹, Mengfei Xu¹, Haozhe Zeng¹, Kai Tao¹, Zixuan Wu², Jin Wu², Jianmin Miao³, Honglong Chang¹, and Weizheng Yuan¹

¹Northwestern Polytechnical University, CHINA, ²Sun Yat-sen University, CHINA, and

³Shanghai Jiao Tong University, CHINA

a - Bio & Medical MEMS

Industrial Benefactor

W-303.a LATEST ADVANCES IN ETCH AND DEPOSITION PROCESSING TECHNOLOGIES FOR BIOMEMS MANUFACTURING

Huma Ashraf and Dave Thomas
SPTS Technologies, UK

a - Bio & Medical MEMS

Manufacturing for Bio- & Medical MEMS & Microfluidics

Th-403.a A ROBUST MICROFABRICATION PROCESS FOR MICROFLUIDIC DEVICES WITH HIGH RESOLUTION AND ASPECT RATIO FEATURES FOR NEURAL CIRCUITRY MODELING

Tianshuo Wang¹, Hui Zhu², Ziyuan Guo², and Tao Li¹
¹University of Cincinnati, USA and ²Cincinnati Children's Hospital Medical Center, USA

F-503.a BIOHYBRID MICRO PINWHEEL POWERED BY TRAPPED MICROALGAE

Naoto Shimizu, Haruka Oda, Yuya Morimoto, and Shoji Takeuchi
University of Tokyo, JAPAN

M-104.a EVALUATION OF THE PERMEABILITY OF CELL BARRIERS CONSTITUTED OF KIDNEY ORGANOID-DERIVED GLOMERULUS

Ayumu Tabuchi¹, Kensuke Yabuuchi^{2,3}, Yoshiki Sahara², Minoru Takasato^{1,2}, and Ryuji Yokokawa¹
¹Kyoto University, JAPAN and ²Institute of Physical and Chemical Research (RIKEN), JAPAN and ³Osaka University, JAPAN

T-204.a FLEXIBLE, MULTI-SHANK STACKED ARRAY FOR HIGH-DENSITY OMNI DIRECTIONAL INTRACORTICAL RECORDING

Zhejun Guo¹, Longchun Wang¹, Bowen Ji², Ye Xi¹, Bin Yang¹, and Jingquan Liu¹
¹Shanghai Jiao Tong University, CHINA and ²Northwestern Polytechnical University, CHINA

W-304.a PIEZOELECTRIC SWITCHING OF BISTABLE MEMS MEMBRANES IN FLUIDS

Philipp Moll, Georg Pfusterschmied, Michael Schneider, Manuel Dorfmeister, and Ulrich Schmid
Technical University, Wien, AUSTRIA

a - Bio & Medical MEMS

Medical Microsystems

Th-404.a 3D-PRINTED MICROGRATERS FOR SAMPLING OF THE BLOOD VESSEL WALL

Mikael Sandell^{1,2,3}, Stefan Jonsson¹, Wouter van der Wijngaart¹, Göran Stemme¹, Staffan Holmin^{2,3}, and Niclas Roxhed^{1,2}
¹KTH Royal Institute of Technology, SWEDEN, ²MedTechLabs, SWEDEN, and ³Karolinska Institutet, SWEDEN

F-504.a FACILE FABRICATION OF HIGHLY SENSITIVE PT-BLACK ELECTROCHEMICAL SENSOR FOR L-GLUTAMATE DETECTION

Sung Sik Chu¹, Paul Marsh¹, Hung A. Nguyen¹, Randall Olson², Carolyn E. Jones², Miranda M. Lim², and Hung Cao¹
¹University of California, Irvine, USA and ²VA Portland Health Care System, USA

M-105.a HIGHLY STRETCHABLE STRAIN SENSOR AND DETECTING SYSTEM FOR MONITORING OF BLADDER VOLUME

Yujin Jo, Minseok Kang, Heejae Shin, and Sanghoon Lee
Daegu Gyeongbuk Institute of Science & Technology (DGIST), KOREA

- T-205.a MICRODEVICES FOR CELL STIMULATION: INTEGRATED ZINC OXIDE PIEZOELECTRIC NANOSTRUCTURES IN SILICON MICROPARTICLES**
 Laura Lefaix¹, Andreu Blanquer², Lucie Bacakova², Jaume Esteve¹, and Gonzalo Murillo¹
¹*Instituto de Microelectrónica de Barcelona, SPAIN* and ²*Czech Academy of Sciences, CZECH REPUBLIC*
- W-305.a NEUTRALIZED MICRO-DROPLET GENERATED BY ON-CHIP ELECTROHYDRODYNAMIC**
 Hang T. Nguyen¹, Tung T. Bui¹, Canh-Dung Tran², Trinh D. Chu¹, Hieu T. Vu³, Dzung V. Dao³,
 and Van T. Dau³
¹*Vietnam National University, VIETNAM*, ²*University of Southern Queensland, AUSTRALIA*, and
³*Griffith University, AUSTRALIA*
- Th-405.a THERMAL STRAIN-INDUCED SELF-ROLLING MESH CUFF ELECTRODES FOR NON-LINEAR PERIPHERAL NERVE**
 Bowen Ji¹, Lin Chen², Minghao Wang³, Zhejun Guo⁴, Yuhao Zhou¹, Shuaiqi Huangfu¹, Kai Zhang¹,
 Huicheng Feng¹, Honglong Chang¹, and Jingquan Liu⁴
¹*Northwestern Polytechnical University, CHINA*, ²*Xi'an Jiaotong University, CHINA*, ³*Hangzhou Dianzi University, CHINA*, and ⁴*Shanghai Jiao Tong University, CHINA*

a - Bio & Medical MEMS

MEMS & BioMEMS for Healthcare and Public Health

- F-505.a GHZ BULK-ACOUSTIC-WAVE RESONATOR ACTUATED HANDHELD ULTRA-CENTRIFUGAL CHIP**
 Xingchen Li¹, Weiwei Cui¹, Shuchang Liu¹, Guanyu Zhang¹, Xingli Xu¹, and Mark A. Reed^{1,2}
¹*Tianjin University, CHINA* and ²*Yale University, USA*
- M-106.a ROLLING CIRCLE AMPLIFICATION IN BEAD-BASED MICROFLUIDIC DEVICE WITH INTEGRATED PHOTODIODE FOR FLUORESCENCE SIGNAL TRANSDUCTION**
 Catarina R.F. Caneira¹, Ruben R.G. Soares², Katerina Nikolaidou¹, Mats Nilsson², Narayanan Madaboosi²,
 Virginia Chu¹, and João P. Conde^{1,3}
¹*Instituto de Engenharia de Sistemas e Computadores, PORTUGAL*, ²*Stockholm University, SWEDEN*, and
³*Universidade de Lisboa, PORTUGAL*

a - Bio & Medical MEMS

Nanobiotechnology

- T-206.a DIRECTING CELL MIGRATION WITH PATTERNED NANOSTRUCTURES**
 Yijun Cheng, Shuyan Zhu, and Stella W. Pang
 City University of Hong Kong, HONG KONG

a - Bio & Medical MEMS

Other Bio and Medical MEMS

- W-306.a MICROFLUIDIC CULTURE MODEL FOR DRUG SCREENING ON SCHISTOSOME PARASITES**
 Vincent Girod^{1,2,3}, Marie-José Ghoris², Jérôme Vicogne², and Vincent Senez¹
¹*CNRS, FRANCE*, ²*Institut Pasteur de Lille, FRANCE*, and ³*Université de Lille, FRANCE*

a - Bio & Medical MEMS

Tissue Engineering

- Th-406.a LIVING SKIN AS A SELF-REPAIRABLE COVERING MATERIAL FOR ROBOTS**
 Michio Kawai, Minghao Nie, Haruka Oda, Yuya Morimoto, and Shoji Takeuchi
 University of Tokyo, JAPAN

b - Emerging Technologies & New Opportunities for MEMS/NEMS
Academic Benefactor

- W-337.b THE INTERDISCIPLINARY MICROSYSTEMS GROUP (IMG) AT UNIVERSITY OF FLORIDA**
Toshi Nishida, Mark Sheplak, Hugh Fan, David Arnold, Saeed Moghaddam, Y.K. Yoon, Jack Judy,
Roosbeh Tabrizian, Jennifer Andrew, Philip X.-L. Feng
University of Florida, USA

b - Emerging Technologies & New Opportunities for MEMS/NEMS
Industrial Benefactor

- T-232.b IMPROVING YOUR UNDERSTANDING OF ADVANCED MEMS DESIGN PROBLEMS: FASTER DESIGN AND SIMULATION FOR BETTER RELIABILITY, MANUFACTURING AND PERFORMANCE**
Chris Welham¹, Arnaud Parent¹, Brian Van Dyk², and Hideyuki Maekoba³
¹Coventor, A Lam Research Company, FRANCE, ²Coventor, A Lam Research Company, USA, and ³Lam Research Corporation, JAPAN
- Th-431.b RESURGENCE OF “MEMS ON CMOS” DEVICES FOR EMERGING APPLICATIONS**
Yen Aik Tan, Mohanraj Soundara Pandian, Arjun Kumar Kantimahanti, and Venkatesh Madhavan
SilTerra Malaysia Sdn Bhd, MALAYSIA
- M-132.b A JOURNAL: MICROSYSTEMS & NANOENGINEERING**
Tianhong Cui¹, Tuanjie Liu², Chengyao Gao², Na Li², and Wang Ruan²
¹University of Minnesota, USA and ²Microsystems & Nanoengineering, China
- T-233.b HETERODYNE LOW-COHERENCE IR-DOPPLER VIBROMETER FOR MEASUREMENT OF ENCAPSULATED SILICON MEMS**
Marco Wolfer, Marcus Winter, Moritz Giesen, Markus Heilig, and Volker Seyfried
Polytec GmbH, GERMANY

b - Emerging Technologies & New Opportunities for MEMS/NEMS
Machine Learning (ML) & Artificial Intelligence (AI)-Enhanced MEMS/NEMS Design, Manufacturing, and Applications

- F-506.b SMART SOFT ROBOTIC MANIPULATOR FOR ARTIFICIAL INTELLIGENCE OF THINGS (AIOT) BASED UNMANNED SHOP APPLICATIONS**
Zhongda Sun¹, Minglu Zhu¹, Zixuan Zhang¹, Zhaocong Chen¹, Qiongfeng Shi¹, Xuechuan Shan^{1,2}, and Chengkuo Lee¹
¹National University of Singapore, SINGAPORE and ²Agency for Science, Technology and Research (A*STAR), SINGAPORE

b - Emerging Technologies & New Opportunities for MEMS/NEMS
MEMS/NEMS for Advancing Scientific Instrumentation and Metrology

- M-107.b AN ATMOSPHERIC MICROPLASMA GENERATOR WITH LOW BREAKDOWN VOLTAGES**
Liwei Jiang, Chenxiang Zhang, Chuan Fang, He-Ping Li, and Zheyao Wang
Tsinghua University, CHINA
- T-207.b RESONANT MICROCANTILEVER BASED MICRO THERMAL GRAVIMETRIC ANALYZER (μ -TGA)**
Fanglan Yao^{1,2}, Xinyu Li^{1,2}, Pengcheng Xu^{1,2}, Haitao Yu¹, and Xinxin Li^{1,2}
¹Chinese Academy of Sciences (CAS), CHINA and ²University of Chinese Academy of Sciences, CHINA

b - Emerging Technologies & New Opportunities for MEMS/NEMS
New Computing Devices and Systems with MEMS/NEMS

- W-307.b DESIGN AND DEMONSTRATION OF MICRO-ELECTROMECHANICAL RESONATOR-BASED MULTIPLIERS**
 Xuecui Zou, Sally Ahmed, and Hossein Fariborzi
King Abdullah University of Science and Technology, SAUDI ARABIA
- Th-407.b HYBRID NANO-ELECTROMECHANICAL SWITCH AND RESISTIVE MEMORY IN SILICON NANOWIRES BY VLSI NEMS**
 Rui Yang^{1,2}, Maosong Xie², Yueyang Jia², Laurent Duraffourg³, and Philip X.-L. Feng^{1,4}
¹Case Western Reserve University, USA, ²Shanghai Jiao Tong University, CHINA, ³CEA-Leti, FRANCE, and ⁴University of Florida, USA

b - Emerging Technologies & New Opportunities for MEMS/NEMS
Nonlinear Dynamics in MEMS/NEMS

- F-507.b DEVELOPMENT OF SYSTEMATIC FITTING MODEL FOR NONLINEAR NANO-ELECTROMECHANICAL RESONANCE ANALYSIS**
 Fang Ben, James Fernando, Jun-Yu Ou, and Yoshishige Tsuchiya
 University of Southampton, UK
- M-108.b EXPERIMENTAL EVIDENCE OF MECHANICAL FREQUENCY COMB IN A QUAD-MASS MEMS STRUCTURE**
 Giorgio Gobat¹, Valentina Zega¹, Patrick Fedeli², Luca G. Falorni², Luca Guerinoni², Cyril Touzé³, and Attilio Frangi¹
¹Politecnico di Milano, ITALY, ²STMicroelectronics, ITALY, and ³École Nationale Supérieure de Techniques Avancées, FRANCE

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS
Advancement in Conventional Materials for MEMS & NEMS

- T-208.c A METHOD FOR OVER 100,000 G IMPACT TEST ON NANOSCALE FILM**
 Leijian Cheng, Fengyang Li, and Dacheng Zhang
Peking University, CHINA
- W-308.c EXTRACTION OF D_{31} PIEZOELECTRIC COEFFICIENT OF AIN THIN FILM**
 Bhadri Narayanan K N, Deleep R. Nair, and Amitava DasGupta
Indian Institute of Technology, Madras, INDIA
- Th-408.c PZT MEMS ACTUATOR WITH INTEGRATED BURIED PIEZORESISTORS FOR POSITION CONTROL**
 Andrea Vergara¹, Takashiro Tsukamoto¹, Weileun Fang², and Shuji Tanaka¹
¹Tohoku University, JAPAN and ²National Tsing Hua University, TAIWAN

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS
Digital Micromanufacturing

- F-508.c A FLEXIBLE, DIGITAL LIGHT PROCESSING (DLP) 3D PRINTED AND COATED MICRONEEDLE ARRAY ($C_{\mu}NA$) FOR PRECISION DELIVERY OF NOVEL NANOTHERAPEUTICS TO PLANT TISSUE**
 Laboni Santra, Avra Kundu, and Swaminathan Rajaraman
University of Central Florida, USA

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS

Generic MEMS & NEMS Manufacturing Techniques

- M-109.c INVESTIGATION OF DEEP DRY ETCHING OF 4H SIC MATERIAL FOR MEMS APPLICATIONS USING DOE MODELLING**
Kolja Erbacher¹, Piotr Mackowiak¹, Michael Schiffer¹, Klaus-Dieter Lang¹, Martin Schneider-Ramelow¹, and Ha-Duong Ngo^{1,2}
¹Fraunhofer IZM, GERMANY and ²University of Applied Sciences Berlin, GERMANY
- T-209.c OPTIMIZATION OF AlN AND AlScN FILM ICP ETCHING**
Zhifang Luo^{1,2,3}, Shuai Shao^{1,2,3}, and Tao Wu^{1,2,3}
¹ShanghaiTech University, CHINA, ²Chinese Academy of Sciences, CHINA, and ³University of Chinese Academy of Sciences, CHINA
- W-309.c TOWARDS A SCALABLE SUN POSITION SENSOR WITH MONOLITHIC INTEGRATION OF THE 3D OPTICS FOR MINIATURIZED SATELLITE ATTITUDE CONTROL**
Joost Romijn¹, Sten Vollebregt¹, Henk W. van Zeijl¹, Guoqi Zhang¹, Johan Leijtens², and Pasqualina M. Sarro¹
¹Delft University of Technology, THE NETHERLANDS and ²Lens R&D BV, THE NETHERLANDS

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS

New & Emerging Materials for MEMS/NEMS

- Th-409.c CHARACTERIZATION OF DIELECTRIC AND PIEZOELECTRIC PROPERTIES OF FERROELECTRIC AlScN THIN FILMS**
Michele Pirro, Bernard Herrera, Meruyert Assylbekova, Gabriel Giribaldi, Luca Colombo, and Matteo Rinaldi
Northeastern University, USA
- F-509.c COMPENSATION OF CONTACT NATURE-DEPENDENT ASYMMETRY IN THE LEAKAGE CURRENT OF FERROELECTRIC $\text{Sc}_x\text{Al}_{1-x}\text{N}$ THIN-FILM CAPACITORS**
Gabriel Giribaldi, Michele Pirro, Bernard Herrera Soukup, Meruyert Assylbekova, Luca Colombo, and Matteo Rinaldi
Northeastern University, USA
- M-110.c SM-DOPED $\text{Pb}(\text{Mg}_{1/3}, \text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$ SPUTTER-EPITAXY ON SI TOWARDS GIANT-PIEZOELECTRIC THIN FILM FOR MEMS**
Xuanmeng Qi, Shinya Yoshida, and Shuji Tanaka
Tohoku University, JAPAN
- T-210.c STRAIN-MODULATED EQUIVALENT CIRCUIT MODEL AND DISSIPATION MODEL FOR 2D MoS_2 NEMS RESONATORS**
Pengcheng Zhang, Yueyang Jia, Sheng Shen, and Rui Yang
Shanghai Jiao Tong University, CHINA

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS

New Fabrication Processes for Making MEMS/NEMS

- W-310.c A METHOD TO IMPROVE FABRICATION ACCURACY OF THREE-DIMENSIONAL MICROSTRUCTURES IN FOCUSED ION BEAM BITMAP MILLING**
Tian Han, Yan Xing, Chen Fang, Zaifa Zhou, and Xiaoli Qiu
Southeast University, CHINA

- Th-410.c A VERSATILE AND ENVIRONMENTALLY FRIENDLY MICROFABRICATION PROCESS FOR PRODUCING MICRO-BASIN ARRAY FOR SINGLE CELL ANALYSIS**
Feng Tian¹, Meixi Li^{2,3}, Dong Pu¹, Bo Yao¹, Yang Xu¹, Dayong Wu², Lei Li², and Huan Hu¹
¹Zhejiang University, CHINA, ²Chinese Academy of Sciences (CAS), CHINA, and ³University of Chinese Academy of Sciences, CHINA
- F-510.c FLEXIBLE PIEZO-MEMS FABRICATION PROCESS BASED ON THINNED PIEZOELECTRIC THICK FILM**
Zhiran Yi, Wenming Zhang, and Bin Yang
Shanghai Jiao Tong University, CHINA
- M-111.c LANGASITE MICROMACHINING TECHNOLOGY APPLIED TO SURFACE ACOUSTIC WAVE SENSORS IN ULTRA-HIGH TEMPERATURES**
Fangmeng Xu and Qiulin Tan
North University of China, CHINA
- T-211.c ON-DEMAND METAL DEPOSITION UTILIZING A CORE-SHELL MICRO-PLASMA-BUBBLE INJECTOR**
Yu Yamashita, Keita Ichikawa, Natsumi Basaki, Shinya Sakuma, and Yoko Yamanishi
Kyushu University, JAPAN
- W-311.c SPIN-SPRAY DEPOSITION OF SPIN ON GLASS USING MEMS ATOMIZER**
Pallavi Sharma and Nathan Jackson
University of New Mexico, USA
- Th-411.c THIN-WALLED CYLINDRICAL NICKEL ELECTROPLATED TUBES FOR APPLICATION IN MICROFLUIDIC DENSITY AND MASS FLOW SENSORS**
Mahdieh Yariesbouei¹, Remco J. Wiegerink¹, Remco G.P. Sanders¹, and Joost C. Lötters^{1,2}
¹University of Twente, THE NETHERLANDS and ²Bronkhorst High-Tech BV, THE NETHERLANDS

c - Materials, Fabrication and Packaging for Generic MEMS & NEMS
Packaging & Assembly

- F-511.c LIQUID METAL AS ELECTRICAL INTERFACE MATERIAL WITH TEMPORAL STABILITY AND STRETCH TOLERANCE**
Takashi Sato¹, Kento Yamagishi², Michinao Hashimoto², and Eiji Iwase¹
¹Waseda University, JAPAN and ²Singapore University of Technology and Design, SINGAPORE
- M-112.c MEMS-BASED "MULTI-TACTILE SCANNER" WITH 100 μ M SPATIAL RESOLUTION OF HARDNESS**
Yoshihiro Nishida¹, Kazuki Watatani^{1,2}, Kyohey Terao¹, Fusao Shimokawa¹, and Hidekuni Takao^{1,2}
¹Kagawa University, JAPAN and ²Japan Science and Technology Agency (JST), JAPAN
- T-212.c MODELING OF SMALL-SIZED ACOUSTIC PARTICLE VELOCITY HORN FOR MEMS THERMAL ACOUSTIC PARTICLE VELOCITY SENSOR**
Wenhan Chang, Lingmeng Yang, Zhezheng Zhu, Zhenchuan Yang, Chengchen Gao, and Yilong Hao
Peking University, CHINA

d - MEMS Actuators & Power MEMS
Actuator Components & Systems

- W-312.d A DUAL-ELECTRODE MEMS SPEAKER BASED ON CERAMIC PZT WITH IMPROVED SOUND PRESSURE LEVEL BY PHASE TUNING**
Haoran Wang¹, Philip X.-L. Feng¹, and Huikai Xie²
¹University of Florida, USA and ²Beijing Institute of Technology, CHINA

- Th-412.d ELECTROLYSIS-DRIVEN REVERSIBLE ACTUATION USING MICROMACHINED PH-SENSITIVE HYDROGEL**
 Rebecca Campbell¹, Diane Buton¹, Seung H. Song², and Albert Kim¹
¹Temple University, USA and ²Sook Myung Women's University, KOREA
- F-512.d FABRICATION OF TACTILE DISPLAY USING ARRAYED SMA FILM ACTUATOR ON SILICON TSV SUBSTRATE WITH INDIVIDUALLY CONDUCTING DIODE**
 Ryo Saito, Yusuke Kimura, Jiale Xu, and Takashi Mineta
 Yamagata University, JAPAN
- M-113.d GENETIC ALGORITHM FOR THE DESIGN OF FREEFORM GEOMETRIES IN A LARGE-RANGE ROTARY MICROGRIPPER**
 Chen Wang^{1,2,3}, Xiaoxiao Song⁴, Yuan Wang⁴, Aojie Quan³, Linlin Wang³, Michiel Gidts³, Sina Sadeghpour³, Jian Bai¹, Huafeng Liu⁴, and Michael Kraft³
¹Zhejiang University, CHINA, ²University of Liege, BELGIUM, ³University of Leuven, BELGIUM, and ⁴Huazhong University of Science and Technology, CHINA
- T-213.d HIGH TORQUE ELECTROSTATIC MICROMOTOR FABRICATED USING POLYMUMPS FOR OPTICAL SCANNING APPLICATIONS**
 Amit Gour¹, Michaël Ménard², and Frederic Nabki¹
¹École de Technologie Supérieure, CANADA and ²University of Québec, CANADA
- W-313.d TOWARDS ULTRASONICALLY ACTUATED PROGRAMMABLE POLYMORPHIC SOFT ACTUATOR**
 JuHong Nam, Youngju Oh, Eunjeong Byun, Eunseo Joo, Soryeong Jeong, Esther Kim, Bongjun Kim, and Seung Hyun Song
 Sookmyung Women's University, KOREA

d - MEMS Actuators & Power MEMS

Energy Harvesting Materials, Structures, and Transducers

- Th-413.d HIGH-EFFICIENCY RAINDROPS ENERGY HARVESTER USING INTERDIGITAL ELECTRODE**
 Jian Zhang¹, Boming Lyu¹, Dezhi Nie¹, Hao Yu¹, Kai Tao¹, Yunjia Li², Yongqing Fu³, Qinxiao Dong⁴, Honglong Chang¹, and Weizheng Yuan¹
¹Northwestern Polytechnical University, CHINA, ²Xi'an Jiaotong University, CHINA, ³Northumbria University, UK, and ⁴China Electric Power Research Institute, CHINA
- F-513.d MIURA-ORIGAMI-STRUCTURED W-TUBE ELECTRET POWER GENERATOR WITH WATER-PROOF AND MULTIFUNCTIONAL ENERGY HARVESTING CAPABILITY**
 Yangyang Gao¹, Haiping Yi¹, Fangzhi Li¹, Kai Tao¹, Jin Wu², Jianmin Miao³, Yongqing Fu⁴, Honglong Chang¹, and Weizheng Yuan¹
¹Northwestern Polytechnical University, CHINA, ²Sun Yat-sen University, CHINA, ³Shanghai Jiao Tong University, CHINA, and ⁴Northumbria University, UK
- M-114.d SOLID ION CHANNEL BATTERY DRIVEN BY TRIBOELECTRIC EFFECT FOR MECHANIC ENERGY HARVESTING**
 Di Feng, Yaqi Bi, Lingjie Jia, Jiayi Yang, Zihao Niu, Yan Meng, Sida Liu, Meiqi Wang, Wei Xu, Yong Qin, and Xiuhua Li
 Beijing Jiaotong University, CHINA

d - MEMS Actuators & Power MEMS

Other Actuators & Power MEMS

- T-214.d DEFORMATION SIMULATION OF SOFT SPIRAL-SHAPED HYDROGEL SWIMMERS FOR AUTONOMOUS SWIMMING CONTROL**
 Koki Yoshida and Hiroaki Onoe
 Keio University, JAPAN

W-314.d INCREASING RANGING ACCURACY OF ALUMINUM NITRIDE PMUTS BY CIRCUIT COUPLING

Junxiang Cai^{1,2,3}, Kangfu Liu^{1,2,3}, Liang Lou⁴, Songsong Zhang⁴, Yuandong (Alex) Gu⁴, and Tao Wu^{1,2,3}
¹ShanghaiTech University, CHINA, ²Chinese Academy of Sciences (CAS), CHINA, ³University of Chinese Academy of Sciences, CHINA, and ⁴Shanghai Industrial μ Technology Research Institute, CHINA

d - MEMS Actuators & Power MEMS

Power MEMS Components & Systems

Th-414.d MULTI-PHASE BIPOLAR ROTARY ELECTRET POWER GENERATOR WITH DC OUTPUT CURRENT

Zhe Zhao¹, Yaozheng Wang¹, Tengfei Sun¹, Yunjia Li², Lihua Tang³, Qinxiao Dong⁴, Kai Tao¹, Honglong Chang¹, and Weizheng Yuan¹
¹Northwestern Polytechnical University, CHINA, ²Xi'an Jiaotong University, CHINA, ³University of Auckland, NEW ZEALAND, and ⁴China Electric Power Research Institute, CHINA

d - MEMS Actuators & Power MEMS

Self-Powered Devices and Microsystems

F-514.d KIRIGAMI-STRUCTURED AND SELF-POWERED PRESSURE SENSOR USING ELECTROACTIVE POLYMER

Jen-Hahn Low, Pei-Song Chee, Eng-Hock Lim, and Vinod Ganesan
Universiti Tunku Abdul Rahman, MALAYSIA

e - MEMS Physical & Chemical Sensors

Fluidic Sensors

M-115.e A DUAL-AXIS HAIR FLOW SENSOR BASED ON WEAKLY COUPLED DOUBLE ENDED TUNING FORKS

Xin Guo^{1,2}, Bo Yang^{1,2}, and Cheng Li^{1,2}
¹Southeast University, CHINA and ²Ministry of Education, CHINA

T-215.e ON-CHIP COOLING THERMAL FLOW SENSOR FOR BIOLOGICAL APPLICATIONS

Yuki Okamoto, Thanh-Vinh Nguyen, Hironao Okada, and Masaaki Ichiki
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

W-315.e SIMULTANEOUS MEASUREMENT OF SURFACE TENSION AND VISCOSITY UTILIZING DROPLET MERGING

Thanh-Vinh Nguyen, Hironao Okada, Yuki Okamoto, Yusuke Takei, Atsushi Takei, and Masaaki Ichiki
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

e - MEMS Physical & Chemical Sensors

Force & Displacement Sensors

Th-415.e A NOVEL VISION-BASED TACTILE SENSOR USING PARTICLE IMAGE VELOCIMETRY FOR MULTI-MODAL OBJECT DETECTION AND FORCE SENSING

Ruijia Wang, Chunpeng Jiang, Bin Yang, and Jingquan Liu
Shanghai Jiao Tong University, CHINA

F-515.e A SURFACE ACOUSTIC WAVE PRESSURE SENSOR BASED ON MICRO-CORONA-DISCHARGING EFFECT

Baofa Hu, Zhiwei Li, Yuanjie Wan, Mingpo Li, and Haisheng San
Xiamen University, CHINA

M-116.e DIRECT MEASUREMENT OF IMPACTING FORCE BETWEEN A DROPLET AND A SUPERHYDROPHOBIC BLADE
Thanh-Vinh Nguyen, Hironao Okada, Yuki Okamoto, Yusuke Takei, Atsushi Takei, and Masaaki Ichiki
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN

T-216.e SHAPE-MEASURABLE DEVICE BASED ON ORIGAMI STRUCTURE WITH SINGLE WALLED CARBON NANOTUBE STRAIN SENSOR
Tomoki Mori and Hiroaki Onoe
Keio University, JAPAN

e - MEMS Physical & Chemical Sensors
Gas & Chemical Sensors

W-316.e A CIRCULAR VIBRATING ELECTRODE WITH ENHANCED MASS TRANSFER FOR HIGH-PERFORMANCE ELECTROCHEMICAL SENSOR
Tianyi Zhang, Peng Zhou, Terrence Simon, and Tianhong Cui
University of Minnesota, USA

Th-416.e A CONCAVE MOEMS SCANNING DIFFRACTION GRATING FOR INFRARED MICRO-SPECTROMETER APPLICATIONS
Russell Farrugia, Barnaby Portelli, Ivan Grech, Joseph Micallef, Owen Casha, and Edward Gatt
University of Malta, MALTA

F-516.e A GRAPHENE-BASED THERMAL CONDUCTIVITY DETECTOR FOR LOW POWER GAS DETECTION
Yunhao Peng, Ashrafuzzaman Bulbul, Seungbeom Noh, Shakir-ul Haque Khan, Kyeong Heon Kim, and Hanseup Kim
University of Utah, USA

M-117.e DIFFERENTIAL THERMAL CONDUCTIVITY CO₂ SENSOR
Ethan L.W. Gardner^{1,2}, Andrea De Luca², and Florin Udrea¹
¹University of Cambridge, UK and ²Flusso Ltd, UK

T-217.e IONIZATION POTENTIAL TUNABLE PYROELECTRIC AMBIENT PRESSURE MULTI-GAS DETECTION PLATFORM
KB Vinayakumar¹, Marco Martins¹, João Gaspar¹, and Tanya Hutter²
¹International Iberian Nanotechnology Laboratory, PORTUGAL and ²University of Texas, Austin, USA

W-317.e MICROFABRICATED SEMIPACKED GAS CHROMATOGRAPHY COLUMNS EMBEDDED HIGH DENSITY ELLIPTIC CYLINDRICAL POSTS
Boxin Chen¹, Fei Feng^{1,2}, Yangyang Zhao¹, Qiyong Liu¹, Bin Zhao¹, Lei Li¹, Haimei Zhou¹, and Xinxin Li¹
¹Chinese Academy of Sciences (CAS), CHINA and ²University of Chinese Academy of Sciences, CHINA

Th-417.e MULTIVARIABLE SENSOR BASED ON MXENE AND MACHINE LEARNING FOR SELECTIVE DETECTIONS OF VOCS
Dongsheng Li, Mengjiao Qu, Qian Zhang, and Jin Xie
Zhejiang University, CHINA

e - MEMS Physical & Chemical Sensors
Industrial Benefactor

F-517.e LOWERING BARRIERS FOR NEMS & MEMS TECHNOLOGIES
Andrew Fung, Priyadarshini Mangannavar, and Qader Qureshi
CMC Microsystems, CANADA

M-118.e MEMS CHARACTERIZATION AND CONTROL- ALL IN ONE
Kıvanç Esat and Romain Stomp
Zurich Instruments, SWITZERLAND

e - MEMS Physical & Chemical Sensors

Inertial Sensors

- T-218.e A MICROMECHANICAL MODE-MATCHED GYROSCOPE USING STIFFNESS NONLINEARITY AND ELECTROSTATIC TUNING**
Xuetong Wang, Xudong Zheng, Haibin Wu, Qiongxia Pang, Yaojie Shen, Zhipeng Ma, and Zhonghe Jin
Zhejiang University, CHINA
- W-318.e A NOVEL THREE DEGREE-OF-FREEDOM RESONATOR WITH HIGH STIFFNESS SENSITIVITY UTILIZING MODE LOCALIZATION**
Jianlin Chen, Takashiro Tsukamoto, and Shuji Tanaka
Tohoku University, JAPAN
- Th-418.e A TACTICAL-GRADE MONOLITHIC HORIZONTAL DUAL-AXIS MEMS GYROSCOPE BASED ON OFF-PLANE QUADRATURE COUPLING SUPPRESSION SILICON GRATINGS**
Jian Cui and Qiancheng Zhao
Peking University, CHINA
- F-518.e AN AUTOMATIC-RECOVERY INERTIAL SWITCH BASED ON THE GALINSTAN MARBLES**
Junshan Liu, Zehan Liu, Siqi Zhang, and Zhiguang Tan
Dalian University of Technology, CHINA
- M-119.e DEVELOPMENT OF A Z-AXIS OUT OF PLANE MEMS ACCELEROMETER**
Abhiraj Basavanna^{1,2}, Matthias Dienger¹, Jan Rockstroh¹, Steffen Keller¹, and Alfons Dehe^{1,2}
¹*Hahn Schickard, GERMANY* and ²*University of Freiburg, GERMANY*
- T-219.e EFFECTS OF NON-IDEAL FREQUENCY SPLITS ON LINEAR PARAMETRIC RESONANCE IN MEMS MODE-SPLIT GYROSCOPES**
Haibin Wu, Xudong Zheng, Qiongxia Pang, Yaojie Shen, Xuetong Wang, Zhipeng Ma, and Zhonghe Jin
Zhejiang University, CHINA
- W-319.e ON THE SENSITIVITY OF MODE-LOCALIZED ACCELEROMETERS OPERATING IN THE NONLINEAR DUFFING REGIME**
Hemin Zhang¹, Milind Pandit², Guillermo Sobreviela², Madan Parajuli¹, Dongyang Chen¹, Jiangkun Sun¹, Chun Zhao³, and Ashwin Seshia¹
¹*University of Cambridge, UK*, ²*Silicon Microgravity Ltd., UK*, and ³*Huazhong University of Science and Technology, CHINA*
- Th-419.e PERFORMANCE IMPROVEMENT FOR MEMS GYROSCOPES BY SUPPRESSING THE CIRCUIT PHASE DELAY**
Haibin Wu, Xudong Zheng, Xuetong Wang, Qiongxia Pang, Yaojie Shen, Zhipeng Ma, and Zhonghe Jin
Zhejiang University, CHINA
- F-519.e PROOF OF CONCEPT OF A GRAPHENE-BASED RESONANT ACCELEROMETER**
Daniel Moreno¹, Xuge Fan², Frank Niklaus², and Luis Guillermo Villanueva¹
¹*École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND* and ²*KTH Royal Institute of Technology, SWEDEN*
- M-120.e SENSITIVITY IMPROVEMENT OF THERMAL EXPANSION-BASED ANGULAR MOTION SENSORS WITH THE PARALLEL DISTRIBUTION OF HEATERS**
Huahuang Luo, Jose Cabot, Izhar, and Yi-Kuen Lee
Hong Kong University of Science and Technology, HONG KONG

e - MEMS Physical & Chemical Sensors
Manufacturing Techniques for Physical Sensors

- T-220.e FABRICATION AND CHARACTERIZATION OF FLUIDIC CHANNEL AND DISPENSING NOZZLE INTEGRATED MICROCANTILEVER HEATERS**
 Juhee Ko¹, Faheem Khan², Bong Jae Lee¹, and Jungchul Lee¹
¹Korea Advanced Institute of Science and Technology (KAIST), KOREA and ²Fourien Inc., CANADA

e - MEMS Physical & Chemical Sensors
Materials for Physical Sensors

- W-320.e ANOMALOUS PIEZORESISTIVE CHANGES OF CORE-SHELL STRUCTURED SiC NANOWIRES**
 Akio Uesugi, Shinya Nakata, Kodai Inoyama, Koji Sugano, and Yoshitada Isono
 Kobe University, JAPAN
- Th-420.e CMOS-MEMS Sc_{0.12}Al_{0.88}N-BASED PYROELECTRIC INFARED DETECTOR WITH CO₂ GAS SENSING**
 Doris K.T. Ng, Chong-Pei Ho, Linfang Xu, Tantan Zhang, Li-Yan Siow, Eldwin J. Ng, Hong Cai, Qingxin Zhang, and Lennon Y.T. Lee
 Agency for Science, Technology and Research (A*STAR), SINGAPORE
- F-520.e EFFECT OF NITROGEN-DOPED CONCENTRATION ON THE TCR OF ITO THIN FILMS AT HIGH TEMPERATURE**
 Zhichun Liu, Junsheng Liang, Jian Li, Mingjie Yang, Sen Cao, and Jun Xu
 Dalian University of Technology, CHINA
- M-121.e IMPROVED SPECIFIC DETECTIVITY TO 10⁷ FOR CMOS-MEMS PYROELECTRIC DETECTOR BASED ON 12%-DOPED SCANDIUM ALUMINUM NITRIDE**
 Doris K.T. Ng, Tantan Zhang, Li-Yan Siow, Linfang Xu, Chong-Pei Ho, Hong Cai, Lennon Y.T. Lee, Qingxin Zhang, and Navab Singh
 Agency for Science, Technology and Research (A*STAR), SINGAPORE

e - MEMS Physical & Chemical Sensors
Metrology and Measurement Techniques for MEMS/NEMS Sensors

- T-221.e MICRO THERMAL FLOW SENSOR FOR ION SOLUTION BASED ON THE MONITORING OF SLOPE OF IMPEDANCE CHANGES**
 Zetao Fang, Xuankai Xu, Jiufu Zheng, Li Zhang, Yatao Yang, and Wei Xu
 Shenzhen University, CHINA

e - MEMS Physical & Chemical Sensors
Nanoscale Physical Sensors

- W-321.e INFRARED METAMATERIAL-BASED MOLECULAR RULER**
 Long Sun^{1,2}, Zhitao Zhou¹, and Tiger H. Tao^{1,2}
¹Chinese Academy of Sciences (CAS), CHINA and ²University of Chinese Academy of Sciences, CHINA
- Th-421.e LINEARIZATION OF OUTPUT FROM NANO-ELECTROMECHANICAL SYSTEMS BY OPTIMALLY COMBINED HIGH-ORDER HARMONICS**
 Keita Funayama^{1,2}, Hiroya Tanaka¹, Jun Hirokuni², Keiichi Shimaoka¹, Yutaka Ohno², and Yukihiko Tadokoro¹
¹Toyota Central R&D Labs., Inc., JAPAN and ²Nagoya University, JAPAN

F-521.e SOLIDLY MOUNTED BULK ACOUSTIC WAVE RESONANT MAGNETIC FIELD SENSOR BASED ON MAGNETOELASTIC EFFECT

Cong Chen, Libing Bai, Quan Zhou, Lulu Tian, Yuhua Cheng, and Jie Zhang
University of Electronic Science and Technology of China, CHINA

M-122.e WIDE BANDWIDTH LORENTZ-FORCE MAGNETOMETER BASED ON LATERAL OVERTONE BULK ACOUSTIC RESONATOR

Shuai Shao^{1,2,3}, Anming Gao⁴, Yuxi Wang^{1,2,3}, and Tao Wu^{1,2,3}
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e - MEMS Physical & Chemical Sensors

Other Physical Sensors

T-222.e DESIGN, FABRICATION AND CHARACTERIZATION OF ACTIVE ATOMIC FORCE MICROSCOPE CANTILEVER ARRAYS

Mohammadreza Soleymaniha, M. Bulut Coskun, Hazhir Mahmoodi Nasrabadi, Afshin Alipour, and S.O. Reza Moheimani
University of Texas, Dallas, USA

e - MEMS Physical & Chemical Sensors

Sonic & Ultrasonic MEMS Transducers

W-322.e 9.5 % SCANDIUM DOPED AlN PMUT COMPATIBLE WITH PRE-PROCESSED CMOS SUBSTRATES

Eyglis Ledesma, Iván Zamora, Arantxa Uranga, and Núria Barniol
Universitat Autònoma de Barcelona, SPAIN

Th-422.e A HIGH-DENSITY AND DUAL-FREQUENCY PMUT ARRAY BASED ON THIN CERAMIC PZT FOR ENDOSCOPIC PHOTOACOUSTIC IMAGING

Haoran Wang¹, Philip X.-L. Feng¹, and Huikai Xie²
¹*University of Florida, USA* and ²*Beijing Institute of Technology, CHINA*

F-522.e A SINGLE CHIP DIRECTIONAL LOUDSPEAKER BASED ON PMUTS

Zhichun Shao, Sedat Pala, Yue Liang, Yande Peng, and Liwei Lin
University of California, Berkeley, USA

M-123.e AN ENHANCED-DIFFERENTIAL PMUT FOR ULTRA-LONG DISTANCE MEASUREMENT IN AIR

Guixiang Cai¹, Xuemei Zhou¹, Yongjie Yi², Hong Zhou¹, Dongxiao Li¹, Jiajia Zhang³, He Huang⁴, and Xiaojing Mu¹
¹*Chongqing University, CHINA*, ²*Chongqing United Microelectronics Center, CHINA*, ³*Chongqing University of Posts and Telecommunications, CHINA* and ⁴*Suzhou Institute of Nano-Tech and Nano-Bionics, CHINA*

T-223.e CHARACTERIZATION OF CAPACITIVE MICROMACHINED ULTRASOUND TRANSDUCER (CMUT) FOR TARGETED APPLICATIONS IN HARSH ENVIRONMENTS

Nooshin Saeidi^{1,2}, Karman F.R.G.M. Selvam¹, Felipe de Souza Tortato¹, Maulik Satwara², and Maik Wiemer¹
¹*Fraunhofer Institute for Electronic Nano Systems, GERMANY* and
²*Chemnitz University of Technology, GERMANY*

W-323.e MULTI-FREQUENCY IMAGING WITH A CMOS COMPATIBLE SCANDIUM DOPED ALUMINUM NITRIDE PMUT ARRAY

Margo Billen¹, Hang Gao¹, Dries Tabruyn¹, Eloi Marigó², Mohan Soundara-Pandian², Philippe Helin¹, and Veronique Rochus¹
¹*Imec, BELGIUM* and ²*Silterra, MALAYSIA*

Th-423.e ULTRASOND-INDUCED HAPTIC SENSATIONS VIA PMUTS

Sedat Pala, Zhichun Shao, Yande Peng, and Liwei Lin
University of California, Berkeley, USA

f - MEMS/NEMS for Optical, RF and Electromagnetics

Free Space Optical Components & Systems

F-523.f ARTIFICIAL DROSOPHILA COMPOUND EYE COMPOSED OF CURVED MICRO-LENS ARRAY USING DIRECT LASER WRITING

Shuai Wei^{1,2}, Zhitao Zhou¹, and Tiger H. Tao^{1,2}

¹Chinese Academy of Sciences (CAS), CHINA and ²University of Chinese Academy of Sciences, CHINA

f - MEMS/NEMS for Optical, RF and Electromagnetics

Infrared (IR) Sensors and Imaging Systems

M-124.f A MEMS ZERO POWER CROP WATER STRESS DETECTOR BASED ON THERMAL INFRARED SENSING

Antea Risso, Vageeswar Rajaram, Sungho Kang, Sila Deniz Calisgan, Zhenyun Qian, and Matteo Rinaldi
Northeastern University, USA

T-224.f A ROBUST INFRARED TRANSDUCER BEYOND 2K × 2K PIXELS

Defang Li, Jinying Zhang, Qingfeng Shi, Qifeng Li, Dongdong Zhao, and Zhuo Li
Beijing Institute of Technology, CHINA

W-324.f DETECTIVITY ENHANCEMENT FOR CMOS-MEMS IR SENSOR BY THERMOCOUPLE ARRANGEMENT

Yu-Cheng Huang¹, Pen-Sheng Lin¹, Yen-Lin Chen¹, Chih-Fan Hu², and WeiLeun Fang¹

¹National Tsing Hua University, TAIWAN and ²PixArt Imaging Inc, TAIWAN

Th-424.f UNCOOLED ZERO-BIAS GRAPHENE MID-INFRARED DETECTORS

Jingxuan Wei, Cheng Xu, Bowei Dong, and Chengkuo Lee
National University of Singapore, SINGAPORE

f - MEMS/NEMS for Optical, RF and Electromagnetics

Manufacturing for Electromagnetic Transducers

F-524.f BACKSIDE ILLUMINATION SPR GENERATING STRUCTURE FOR EFFICIENT LIGHT COUPLING

Tetsuo Kan, Yoshiki Saito, and Shinichi Suzuki
University of Electro-Communications, JAPAN

M-125.f ENHANCING THE RELEASE PROCESS YIELD FOR CMOS-MEMS METAL RESONATORS BASED ON DIFFUSION-CONTROLLING STRUCTURES

Cheng-En Hsu and Wei-Chang Li
National Taiwan University, TAIWAN

f - MEMS/NEMS for Optical, RF and Electromagnetics

MEMS for Timing & Frequency Control

T-225.f ENHANCEMENT OF FREQUENCY STABILITY IN INJECTION LOCKED BULK MODE MEMS OSCILLATORS

Madan Parajuli, Guillermo Sobreviela, Hemin Zhang, and Ashwin A. Seshia
University of Cambridge, UK

W-325.f PERFORMANCE ENHANCEMENT AND RESTORATION OF MICROMECHANICAL RESONATORS VIA UV-OZONE TREATMENT

Qianyi Xie, Sherwin A. Afshar, Alper Ozgurluk, and Clark T.-C. Nguyen
University of California, Berkeley, USA

Th-425.f RESILIENT ULTRA STABLE CMOS-MEMS OSCILLATOR WITH RECEIVER IN INTEL 22FFL TECHNOLOGY

Sarah Shahraimi¹, Hao Lue¹, Timo Huusari¹, Eduardo Alban¹, Somnath Kundu¹, Rinkle Jain¹, Jason Mix¹, Brent Carlton¹, Reza Abdolvand², Mohamed Abdelmoneum¹, and Nasser Kurd¹
¹Intel, USA and ²University of Central Florida, USA

f - MEMS/NEMS for Optical, RF and Electromagnetics
Other Electromagnetic MEMS/NEMS

F-525.f LIQUID METAL-BASED FLEXIBLE BAND-STOP FREQUENCY SELECTIVE SURFACE

Arkadeep Mitra¹, Kevin Xu², Sachin Babu¹, Jun H. Choi², and Jeong-Bong Lee¹
¹University of Texas, Dallas, USA and ²University at Buffalo, USA

f - MEMS/NEMS for Optical, RF and Electromagnetics
Photonic Components & Systems

M-126.f ELECTROWETTING-BASED TUNABLE LIQUID DROPLET MICRORESONATOR

WeiYang Lim, Mo Zohrabi, JianGang Zhu, Juliet T. Gopinath, and Victor M. Bright
University of Colorado, Boulder, USA

T-226.f MEMS SHUTTER BASED VARIABLE OPTICAL ATTENUATOR INTEGRATED WITH LARGE CORE MULTIMODE RECTANGULAR WAVEGUIDES

Anton Lagosh¹, Benedikt Guldemann², Gergely Huszka¹, Hamed Sattari¹, Berit Ahlers², Grégoire Kerr³, Mauro Melozzi⁴, Peyman Rahnama⁴, Takeshi Nishizawa³, and Niels Quack¹
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³OHB System AG, GERMANY, and ⁴Micos Engineering, SWITZERLAND

f - MEMS/NEMS for Optical, RF and Electromagnetics
RF MEMS Components & Systems

W-326.f DISTINCT AKHIEZER DAMPING EFFECTS ON MULTI-FREQUENCY WHISPERING GALLERY MODE RESONATORS

Zeji Chen^{1,2,3}, Qianqian Jia^{1,2,3}, Wenli Liu^{1,2,3}, Yinfang Zhu^{1,2}, Quan Yuan^{1,2}, Jinling Yang^{1,2,3}, and Fuhua Yang^{1,2}
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³State Key Laboratory of Transducer Technology, CHINA

Th-426.f FABRICATION AND ANALYSIS OF THIN FILM LITHIUM NIOBATE RESONATORS FOR 5GHz FREQUENCY AND LARGE K_T² APPLICATIONS

Soumya Yandrapalli¹, Seniz Esra Kucuk¹, Baris Atakan¹, Victor Plessky², and Luis Guillermo Villanueva¹
¹École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND and ²GVR Trade SA, SWITZERLAND

F-526.f GAUSSIAN FOCUSED-CAVITY RESONATOR

Aleem M. Siddiqui, Gwen Hummel, Andrew Ian Young, Sean Yen, Darren Branch, and Christopher Nordquist
Sandia National Labs, USA

M-127.f LATERAL FLEXURE CONTACT ON CMOS MEMS ELECTROTHERMAL METAL-METAL CONTACT SWITCH BY PLATINUM ALD SIDEWALL PATTERNING

Yi-Chung Lin¹, Sean Yen², Tamal Mukherjee¹, and Gary K. Fedder¹

¹Carnegie Mellon University, USA and ²Sandia National Laboratories, USA

T-227.f SWITCHABLE TRANSDUCTION IN GaN MEMS WITH OFF-STATE SHUNT

Imtiaz Ahmed and Dana Weinstein

Purdue University, USA

g - Micro- & Nanofluidics

Biological and Medical Microfluidics and Nanofluidics

W-327.g A HUMAN CORNEA-ON-A-CHIP

Zitong Yu, Rui Hao, Yi Zhang, and Hui Yang

Chinese Academy of Sciences (CAS), CHINA

Th-427.g A SUPERHYDROPHOBIC PERFORATED MICROWELL PLATE FOR FACILE AND ROBUST SPHEROID CULTURES IN SITTING-DROP FORMAT

Bangyong Sun, Qiang Zhao, and Gang Li

Chongqing University, CHINA

F-527.g AN INTEGRATED MICROFLUIDIC PLATFORM TO DETECT FXR2 RNA EXPRESSION IN ASCITES FOR DIAGNOSIS OF OVARIAN CLEAR CELL CARCINOMA

Yi-Da Chung¹, Yuan-Jhe Chuang², Chang-Ni Lin², Keng-Fu Hsu², and Gwo-Bin Lee¹

¹National Tsing Hua University, TAIWAN and ²National Cheng Kung University, TAIWAN

M-128.g EFFECT OF PERFUSION CULTURE ON LOCALIZATION, INTENSITY, AND FUNCTIONALITY OF TRANSPORTER PROTEINS IN A BILAYER PROXIMAL TUBULE-ON-A CHIP

Ramin Banan Sadeghian¹, Ryohei Ueno¹, Toshikazu Araoka², Jun Yamashita², Tatsuji Enoki³, Minoru Takasato⁴, and Ryuji Yokokawa¹

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⁴Institute of Physical and Chemical Research (RIKEN), JAPAN

T-228.g EFFICIENT PRODUCTION OF MONODISPERSE GIANT UNILAMELLAR VESICLES BY TRANSFERRING ACROSS THE W-O INTERFACE

Ryota Ushiyama and Hiroaki Suzuki

Chuo University, JAPAN

W-328.g IN SITU GUIDED NEURITE OUTGROWTH BY FEMTOSECOND LASER PROCESSING IN A MICROFLUIDIC DEVICE

Dian Anggraini¹, Kazunori Okano¹, Yo Tanaka², Sohei Yamada¹, Yaxiaer Yalikun^{1,2}, and Yoichiro Hosokawa¹

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²Institute of Physical and Chemical Research (RIKEN), JAPAN

g - Micro- & Nanofluidics

Generic Microfluidics & Nanofluidics

Th-428.g A FLUIDIC DIODE AND ITS APPLICATION TO A VALVELESS MICROPUMP

Peng Zhou, Tianyi Zhang, Terrence Simon, and Tianhong Cui

University of Minnesota, USA

F-528.g A VACUUM-INTEGRATED CENTRIFUGAL MICROFLUIDIC CHIP FOR DENSITY-BASED SEPARATION OF MICROPARTICLES

Cemre Oksuz and H. Cumhur Tekin

Izmir Institute of Technology, TURKEY

M-129.g RUBIK'S CUBE-LIKE MULTIFUNCTIONAL SENSING PLATFORM

Xiaochen Lai^{1,2}, Qing Guo², Zhi Shi², Hao Chen², and Dachao Li²

¹Nanjing University of Information Science & Technology, CHINA and ²Tianjin University, CHINA

g - Micro- & Nanofluidics

Integrated/Embedded Microfluidics and Nanofluidic Systems & Platforms

T-229.g IN-FLOW EXTRACTION OF RNA IN EXTRACELLULAR VESICLES USING A SILICON-BASED MICROFLUIDIC DEVICE

Sihui Chen, Xi Chen, Jing Du, Yi Zhang, and Hui Yang

Chinese Academy of Sciences (CAS), CHINA

W-329.g MINIATURE ACOUSTIC RESONATOR INDUCED IN-SITU ELECTRODE FOUL REMOVAL ENABLING THE CONTINUOUS ELECTROCHEMICAL MEASUREMENTS

Xiaohe Wang, Pengfei Niu, Zongwei Zheng, Xiang She, Yiye Liu, and Wei Pang

Tianjin University, CHINA

g - Micro- & Nanofluidics

Manufacturing for Micro- and Nanofluidics

Th-429.g 3D PRINTING FOR MICROGEL-BASED LIVER CELL ENCAPSULATION

Jonathan S. O'Connor^{1,2}, Heesoo Kim^{1,3}, Eunheui Gwag^{1,4}, Leon Abelman^{1,2,5}, Baeckkyoung Sung^{1,4}, and Andreas Manz^{1,2}

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⁴University of Science & Technology, KOREA, and ⁵University of Twente, THE NETHERLANDS

F-529.g ON-THE-FLY RAPID-COOLING GELATION OF MICROGEL BEADS IN CENTRIFUGAL MICROFLUIDIC DEVICE WITH LIQUID NITROGEN

Tomomi Murayama¹, Mio Tsuchiya¹, Koki Yoshida¹, Yuta Kurashina², and Hiroaki Onoe¹

¹Keio University, JAPAN and ²Tokyo Institute of Technology, JAPAN

g - Micro- & Nanofluidics

Materials for Micro & Microfluidics

M-130.g PERFORMANCE MAXIMIZATION OF BIPOLAR IONIC DIODES THROUGH GEOMETRY OPTIMIZATION OF MULTI-LAYERED MICROCHANNEL AND ITS APPLICATIONS

Jaehyun Kim, Heejin Jeon, Cong Wang, Gyu Tae Chang, and Jungyul Park

Sogang University, KOREA

g - Micro- & Nanofluidics

Other Micro- and Nanofluidics

T-230.g MICRO GAS CHROMATOGRAPHIC COLUMNS WITH METAL-ORGANIC FRAMEWORKS AS STATIONARY PHASE

Yangyang Zhao^{1,3}, Boxin Chen^{1,2}, Qiyong Liu^{1,2}, Xinxin Li^{1,2}, Dan Zheng^{1,3}, and Fei Feng^{1,2}

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³Shanghai Institute of Technology, CHINA

g - Micro- & Nanofluidics

Modeling of Micro & Nanofluidics

W-330.g TOWARD GEOMETRIC CONTROL OF LATE-STAGE DIFFUSION PROPERTIES FOR 3D PRINTED BIODEGRADABLE MICROSTRUCTURES

Emmett Z. Freeman, Eleanor C. Grosvenor, Ian B. Rosenthal, Ruben Acevedo, and Ryan D. Sochol
University of Maryland, College Park, USA

h - Industry MEMS and Advancing MEMS for Products and Sustainability

Measurement Methods for Product Specs

Th-430.h STROBOSCOPIC VIDEO MICROSCOPY FOR IN-PLANE MOTION MEASUREMENTS UP TO 2 MHZ WITH PICOMETER RESOLUTION

Andrej Voss, Lars Seyfert, and Werner Hemmert
Technical University, Munich, GERMANY

h - Industry MEMS and Advancing MEMS for Products and Sustainability

MEMS Packaging Techniques

F-530.h EVALUATING FILM ASSISTED MOLDING PACKAGING FOR PEIZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCERS

Teng Hwang Tan¹, Mohanraj Soundara-Pandian¹, Nor Shazwani¹, Eloi Marigo¹, Regis Arul Raj², and Manimaran Subramaniam²
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h - Industry MEMS and Advancing MEMS for Products and Sustainability

MEMS/NEMS - CMOS Integration

M-131.h MANUFACTURABILITY OF HIGHLY DENSED ARRAYS OF SC 20% DOPED AIN MONOLITHIC PMUT

Eloi Marigo, Muhammad Nur Azuan, Anis Amiera, Loh Annie, Nor Shazwani, Chan Buan Fei, and Mohanraj Soundara-Pandian
Silterra Malaysia Sdn. Bhd., MALAYSIA

T-231.h MEMBRANE-HEATER-INTEGRATED LSI FOR ON-SITE ANNEALING-RECOVERY FROM 20 KGY GAMMA RAY IRRADIATION DAMAGE

Tianjiao Gong¹, Yukio Suzuki¹, Akinori Takeyama², Takeshi Ohshima², and Shuji Tanaka¹
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i – Open Posters

Bio & Medical MEMS

M-133.i ADHESIVE TAPE MICROFLUIDICS FOR SINGLE-CELL CRISPR INTERFERENCE EXPERIMENTS ON ANTIBIOTICS SUSCEPTIBILITY AND PERSISTENCE

Santosh Pandey and Taejoon Kong
Iowa State University, USA

M-134.i PORTABLE TEMPERATURE MANAGEMENT SYSTEM FOR MICROFLUIDICS BASED ISOTHERMAL NUCLEIC ACID AMPLIFICATION

Sohan Dudala, Monica Singh, Madhusudan B. Kulkarni, Ruchi Jai Dey, Satish K. Dubey, and Sanket Goel
Birla Institute of Technology and Science (BITS Pilani), INDIA

- M-135.i STRETCHABLE ELECTRODES OF VERTICALLY ALIGNED CARBON NANOTUBES TOWARDS PRESSURE SENSOR AND SUPERCAPACITOR**
Anthony Palumbo, Runzhi Zhang, Grzegorz Hader, and Eui-Hyeok Yang
Stevens Institute of Technology, USA
- T-234.i COMBINATORIAL TESTING OF MULTIDRUG RESISTANCE IN GEL-ENCAPSULATED BACTERIAL CELLS USING DROPLET HOPPING MICROFLUIDICS**
Santosh Pandey and Taejoon Kong
Iowa State University, USA
- T-235.i REALTIME MECHANICAL RESPONSES OF LAMBDA DNA ON THE PROGRAMABLE ELECTRIC FIELD APPLIED BY VIRTUAL CATHODE**
Ken Sasaki, Kenta Hatazawa, and Takayuki Hoshino
Hirosaki University, JAPAN
- W-331.i DEDICATED EXPERIMENTAL PLATFORM FOR THE BIOSENSING OF THE RED BLOOD CELLS DISCRIMINATION WITH GENETIC DISEASE**
Tieying Xu¹, Maria A. Lizarralde-Iragorri², Jean Roman¹, Emile Martincic³, Valentine Brousse², Olivier Français⁴, Wassim El Nemer², and Bruno Le Pioufle¹
¹Université Paris-Saclay, FRANCE, ²Université de Paris, FRANCE, ³C2N, FRANCE, and ⁴ESIEE Paris, FRANCE
- W-332.i RESPIRATION MONITORING DURING 6-MIN WALK USING BELLY BAND SENSOR MEASURING CAPACITANCE BUILT ACROSS SKIN**
Minoru Sasaki¹, Momoko Karita², and Shinya Kumagai¹
¹Toyota Technological Institute, JAPAN and ²Meijo University, JAPAN
- Th-432.i IMPROVEMENT OF CARDIAC CONTRACTILITY BY CONTINUOUS EXCHANGE OF CULTURE MEDIUM**
WooJin Kwon, Geun Woo Kim, Unseon Jeong, Jong Yun Kim, and Dong-Weon Lee
Chonnam National University, KOREA
- Th-433.i SEGMENTATION-BASED QUANTIFICATION OF SINGLE-CELL PROTEIN SEPARATIONS**
Anjali Gopal^{1,2} and Amy E. Herr^{1,2,3}
¹University of California, Berkeley, USA, ²University of California, Berkeley-University of California, San Francisco Joint Graduate Program, USA and ³Chan Zuckerberg BioHub, USA
- F-531.i PATTERNING AND IMMOBILIZATION OF SILVER NANOWIRES ON THE SUBSTRATE FOR FLEXIBLE ELECTRONICS BY USING MICROWAVE ENHANCED GRAFTING CYSTEAMINE**
Sara Khademi¹, Kiyumars Jalili², Wang Hao¹, and Wu Tianzhun¹
¹Shenzhen Institutes of Advanced Technology, CHINA and ²Sahand University of Technology, IRAN
- F-532.i SLIPPERY IMPLANTABLE FLEXIBLE MICROELECTRODE ARRAY FOR HIGH-PERFORMANCE NEURAL INTERFACE**
Md Eshrat E Alahi, Qi Zeng, Hao Wang, and Wu Tianzhun
Chinese Academy of Sciences (CAS), CHINA

i – Open Posters

Emerging Technologies & New Opportunities for MEMS/NEMS

- T-236.i STICTION-BASED NON-VOLATILE MEMORY FOR HARSH ENVIRONMENTS**
Dinesh Pamunuwa, Elliott Worsey, Qi Tang, and Mukesh K. Kulsreshath
University of Bristol, UK
- Th-434.i SIFTING SOIL FOR NEMATODE EGGS USING A MICRO FLOW CHIP, LENS-LESS IMAGING AND DEEP LEARNING NEURAL NET**
Santosh Pandey, Chris Legner, and Upender Kalwa
Iowa State University, USA

i – Open Posters

Industry MEMS and Advancing MEMS for Products and Sustainability

W-333.i NON-DESTRUCTIVE HIGH-RESOLUTION 3D X-RAY TOMOGRAPHY FOR ENCAPSULATED SILICON-BASED MICROELECTROMECHANICAL SYSTEMS

Haiwen Dai¹, Si Ping Zhao¹, Meng Keong Lim¹, and Michael Rauscher²

¹Carl Zeiss PTE LTD, SINGAPORE and ²Carl Zeiss SMT GmbH, GERMANY

i – Open Posters

MEMS Actuators & Power MEMS

M-136.i MODELING AND DESIGN OF TRANSVERSE-TYPE MICRO THERMOELECTRIC GENERATOR USING SILICON NANOWIRES

Hayato Kumagai, Yusaku Shiotsu, and Satoshi Sugahara

Tokyo Institute of Technology, JAPAN

T-237.i TOWARDS A PROTOTYPE 2D-MICROACTUATOR WITH INTEGRATED NdFeB MICROMAGNETS

Georgiana I. Groza, Ryogen Fujiwara, Richard Haettel, Frederico Keller, Andre Dias,

Thibaut Devillers, and Nora M. Dempsey

CNRS Grenoble, FRANCE

W-334.i PARALLEL ACTUATION OF MICRODROPLETS FOR DIGITAL MICROFLUIDIC APPLICATIONS

Santosh Pandey, Taejoon Kong, Riley Brien, and Upender Kalwa

Iowa State University, USA

F-533.i CYBORG BEETLE: SIDEWAYS WALKING CONTROL VIA ELYTRA STIMULATION

Huu-Duoc Nguyen¹, Pak Zan Tan¹, Hirotaka Sato¹, and T. Thang Vo-Doan²

¹Nanyang Technological University, SINGAPORE and ²University of Freiburg, GERMANY

F-534.i WETTABLE ACTUATOR TO CONTROL LIQUID FLOW IN PAPER MICROFLUIDICS DEVICES

Santosh Pandey and Taejoon Kong

Iowa State University, USA

i – Open Posters

MEMS Physical & Chemical Sensors

M-137.i NUMERICAL ANALYSES ON DETECTION TOLERANCES IN HIGH SPATIAL RESOLUTION CAPACITIVE TACTILE SENSORS

Yu-Wen Chen, Mochtar Chandra, and Cheng-Yao Lo

National Tsing Hua University, TAIWAN

W-335.i PEROVSKITE GAS SENSORS: LEAD-FREE LaFeO₃ PELLET FOR NO₂ SENSING

Kyungtaek Lee, Sugato Hajra, Manisha Sahu, and Hoe Joon Kim

Daegu Gyeongbuk Institute of Science and Technology (DGIST), KOREA

Th-435.i INVESTIGATING THE MAXIMAL SAMPLING RATE OF A BIFURCATION BASED MEMS SENSOR

Yoav Kessler, Alex Liberzon, and Slava Krylov

Tel Aviv University, ISRAEL

i – Open Posters

Micro- & Nanofluidics

- M-138.i DIGITAL MICROFLUIDIC DEVICE WITH DOWNWARD ELECTRODES**
Hirotada Hirama¹, Satoshi Yoshii², Yusuke Komazaki¹, Shinya Kano¹, Toru Torii², and Harutaka Mekarū¹
¹*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN and*
²*University of Tokyo, JAPAN*
- T-239.i FABRICATION OF MICROFLUIDIC DEVICES FOR BIOANALYSIS BY PRINTED HYDROGEL MOLDING**
Hirotada Hirama¹, Yusuke Sugiura², Yusuke Komazaki¹, Toru Torii², and Harutaka Mekarū¹
¹*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN and*
²*University of Tokyo, JAPAN*
- W-336.i MICROCAPSULES WITH CONCENTRATED DRUG FOR DISSOLVING MICRONEEDLES**
Hirotada Hirama¹, Yuya Ishikura², Masanori Hayase², and Harutaka Mekarū¹
¹*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN and*
²*Tokyo University of Science, JAPAN*
- Th-436.i NANOPARTICLE ADSORPTION ON POLYDIMETHYLSILOXANE-BASED MICROFLUIDIC DEVICES**
Hirotada Hirama¹, Ryutaro Otahara², Shinya Kano¹, Masanori Hayase², and Harutaka Mekarū¹
¹*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN and*
²*Tokyo University of Science, JAPAN*
- F-535.i TOWARDS A COMPACT LAB-ON-CMOS μ -CALORIMETER: FULLY INTEGRATED MICROFLUIDIC CMOS-MEMS OSCILLATOR WITH 43- μ K / 13-PJ RESOLUTION**
Rafel Perelló-Roig¹, Jaume Verd¹, Ivan de Paúl¹, Sebastia Bota¹, Toshikazu Nishida², and Jaume Segura¹
¹*University of the Balearic Islands, SPAIN and* ²*University of Florida, USA*