

# Monday, August 21

- 12:00 **Registration**
- 13:30 **Welcome Address**  
Sunil Bhave, *Purdue University, USA*  
David Horsley, *University of California, Davis, USA*
- 13:45 **Plenary Speaker I**  
**SOLITONS ON A CHIP: SYNTHESISING OPTICAL FREQUENCY COMBS USING MICRO RESONATORS**  
Tobias Kippenberg  
*Ecole Fédérale Polytechnique de Lausanne, SWITZERLAND*
- 14:45 **Plenary Speaker II**  
**NONLINEAR MODAL INTERACTIONS IN MICRO-/NANO-ELECTROMECHANICAL RESONATORS**  
Ashwin Seshia  
*Cambridge University, UK*
- 15:45 **Break**
- 16:15 **Invited Speaker I**  
**HARNESSING NONLINEAR DYNAMICS IN HIGH PERFORMANCE MEMS GYROSCOPES**  
E. Hwang  
*Analog Devices, USA*
- 17:00 **Adjourn for the Day**
- 17:15 -  
19:15 **Wine & Cheese Welcome Reception**

## Tuesday, August 22

- 08:30 **Invited Speaker II**  
**NONLINEARITY IN MEMS: LEARNING FROM THE PAST,  
LOOKING TOWARD THE FUTURE**  
K. Foster  
*University of California, Santa Barbara, USA*
- 09:15 **Plenary Speaker II**  
**EXPLOIT, DON'T ESCHEW, NONLINEAR MEMS & NEMS**  
Michael Roukes  
*California Institute of Technology, USA*
- 10:15 **Break**
- 10:35 **Contributed Presentation I**  
**MAGNETIC FIELD SENSING USING A FREQUENCY-MODULATED MEMS  
DUAL-RESONATOR**  
S. Sonmezoglu and D.A. Horsley  
*University of California, Davis, USA*
- 10:55 **Contributed Presentation II**  
**DUFFING DUAL HYSTERESIS IN A THERMAL SELF-OSCILLATOR**  
J.M.L. Miller<sup>1</sup>, A. Ansari<sup>2</sup>, D.B. Heinz<sup>1</sup>, I.B. Flader<sup>1</sup>, Y. Chen<sup>1</sup>, D.D. Shin<sup>1</sup>,  
and T.W. Kenny<sup>1</sup>  
<sup>1</sup>*Stanford University, USA and* <sup>2</sup>*California Institute of Technology, USA*
- 11:15 **Invited Speaker III**  
**NONLINEAR MEMS FOR EXPLOSIVE DETECTION**  
J. Rhoads  
*Purdue University, USA*
- 12:00 **Lunch**

- 13:15 **Invited Speaker IV**  
**HYBRID CMOS/NEMS FOR MASSIVELY PARALLEL NEURAL COMPUTING**  
R. Manohar  
*Yale University, USA*
- 14:00 **Invited Speaker V**  
**COUPLED MEMS OSCILLATORS FOR UNCONVENTIONAL SIGNAL PROCESSING**  
D. Weinstein  
*Purdue University, USA*
- 14:45 **Invited Speaker VI**  
**ANALOG MECHANICAL COMPUTING FOR SIMULATING FUSION**  
S. Zotov  
*GE Global Research, USA*
- 15:30 **Poster Session I**  
Refreshments will be served at 15:45

### **Resonators for Sensing, Timing, and RF Applications**

- PT.01 **A NEW APPROACH TO MITIGATING THERMOELASTIC DISSIPATION OF MEMS RESONATORS**  
X. Zhou<sup>1</sup>, D. Xiao<sup>1</sup>, Q. Li<sup>1</sup>, Z. Hou<sup>1</sup>, K. He<sup>2</sup>, Y. Wu<sup>1</sup>, and X. Wu<sup>1</sup>  
<sup>1</sup>*National University of Defense Technology, CHINA and*  
<sup>2</sup>*East China Institute of Photo-Electronic IC, CHINA*
- PT.02 **ALUMINUM NITRIDE CROSS-SECTIONAL LAM<sup>o</sup>-MODE RESONATORS WITH FIGURE-OF-MERIT >134 AND FREQUENCY TUNABILITY OF 70 MHZ/ $\mu$ M**  
G. Chen, C. Cassella, T. Wu, Z. Qian, and M. Rinaldi  
*Northeastern University, USA*
- PT.03 **DESIGN AND FABRICATION OF STRAIN-BASED TUNABLE GRAPHENE NEMS RESONATOR**  
J.H. Cho, I.S. Ladner, N. Hong, G. Sun, and M.A. Cullinan  
*University of Texas, Austin, USA*
- PT.04 **HIGH PRECISION RESONANT DEW POINT METERS**  
M. Mahdavi and S. Pourkamali  
*University of Texas, Dallas, USA*
- PT.05 **INTERNAL RESONANCES OF A GEOMETRICALLY NONLINEAR MICROCANTILEVER-POLYMER SYSTEM**  
K. Asadi<sup>1</sup>, S. Peshin<sup>2</sup>, J. Yeom<sup>2</sup>, and H. Cho<sup>1</sup>  
<sup>1</sup>*Ohio State University, USA and* <sup>2</sup>*Michigan State University, USA*

- PT.06      **THERMAL PIEZORESISTIVE RESONANT MASS BALANCES IMPLEMENTED IN A STANDARD CMOS PROCESS**  
A. Abbasalipour, V. Kumar, M. Mahdavi, and S. Pourkamali  
*University of Texas, Dallas, USA*

### Nonlinear and Non-Reciprocal Microsystems

- PT.07      **ACOUSTOELECTRIC EFFECT IN MICROMACHINED GAN DELAY LINES AND ITS APPLICATION FOR NON-RECIPROCAL ACOUSTIC DEVICES**  
H. Zhu and M. Rais-Zadeh  
*University of Michigan, USA*
- PT.08      **EFFECT OF FREQUENCY RATIO ON NONLINEAR MODE COUPLING AND INTERNAL RESONANCE IN AN H-SHAPED TUNING FORK MICRORESONATOR**  
A. Sarrafan, B. Bahreyni, and F. Golnaraghi  
*Simon Fraser University, CANADA*
- PT.09      **EVALUATION OF CURVED ELECTRODE ACTUATOR DYNAMICS IN VISCOUS DIELECTRIC MEDIA FOR BIOMEMS APPLICATIONS**  
S.P. Burugupally, M.A. Lake, and D.J. Hoelzle  
*Ohio State University, USA*
- PT.10      **MICROELECTROMECHANICAL RESONANT CIRCULATOR (MIRC) BASED ON MODULATING MEMS RESONATORS USING RF SWITCHES**  
Y. Yu<sup>1</sup>, D. Sounas<sup>2</sup>, C. Cassella<sup>1</sup>, Z. Qian<sup>1</sup>, A. Kord<sup>2</sup>, A. Alu<sup>2</sup>, and M. Rinaldi<sup>1</sup>  
*<sup>1</sup>Northeastern University, USA and <sup>2</sup>University of Texas, Austin, USA*
- PT.11      **THEORETICAL LIMITS ON LOSS AND NOISE FIGURE OF NONRECIPROCAL DEVICES BASED ON PARAMETRIC MODULATION**  
J. Krol and S. Gong  
*University of Illinois, Urbana-Champaign, USA*

### Parametric Resonance in the Optical, Mechanical and Acoustic Domains

- PT.12      **THE MEISSNER PARAMETRIC RESONATOR: RESPONSE AT CROSSOVER POINTS AND THEIR RELEVANCE TO POSSIBLE SENSOR AND CLOCKING APPLICATIONS**  
A. Kassie, S. Shmulevich, and D. Elata  
*Technion - Israel Institute of Technology, ISRAEL*

### Optomechanics

- PT.13      **OPTO-MECHANICAL FM ACCELEROMETER WITH FREQUENCY STABILITY OF 2 PPB**  
S. Zotov, M. Wang, S. Lu, Y. Lin, A. Kasten, W. Challener, and T. Miller  
*GE Global Research, USA*

**MEMS/NEMS Logic for Novel Computing Paradigms (Neuromorphic, Quantum, Physical)**

- PT.14      **ELECTROSTATICALLY TUNABLE NEMS RESONATOR AS A LOGIC DEVICE**  
S.N. Kazmi, P.M. Da Costa, and M.I. Younis  
*King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA*
- PT.15      **TOWARD CASCADABLE MICROELECTROMECHANICAL RESONATOR LOGIC ELEMENTS**  
S. Ilyas, M.A. Hafiz, H. Fariborzi, and M.I. Younis  
*King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA*
- 17:00      **Contributed Late News Presentation I**  
**To Be Determined**
- 17:20      **Contributed Late New Presentation II**  
**To Be Determined**
- 17:40      **Adjourn for the Day**
- 19:00      **Workshop Banquet**  
21:00

## Wednesday, August 23

- 09:00 **Contributed Presentation II**  
**A PHONONIC NON-DEGENERATE PARAMETRIC OSCILLATOR**  
A. Ansari, M. Matheny, J. Li, R. Katti, and M. Roukes  
*California Institute of Technology, USA*
- 09:20 **Contributed Presentation IV**  
**SHINING A LIGHT ON MICRORESONATOR DYNAMICS: RF CHARACTERIZATION USING A LASER MICROSCOPE**  
V.J. Gokhale and J.J. Gorman  
*National Institute of Standards and Technology (NIST), USA*
- 09:40 **Contributed Presentation V**  
**ZERO-POWER MULTISPECTRAL INFRARED DIGITIZER BASED ON OPTICALLY ACTUATED MICROMECHANICAL SWITCH**  
S. Kang, V. Rajaram, Z. Qian, N.E. McGruer, and M. Rinaldi  
*Northeastern University, USA*
- 10:00 **Contributed Presentation VI**  
**THICK-FILM MAGNETIC MATERIALS FOR INTEGRATED MICROWAVE SYSTEMS**  
X. Wen, Y. Wang, S. Hwangbo, Y.-K. Yoon, and D.P. Arnold  
*University of Florida, USA*
- 10:20 **Poster Session II**  
Refreshments will be served at 10:20.

### Resonators for Sensing, Timing, and RF Applications

- PW.01 **A TECHNIQUE FOR SUPPRESSION OF MULTIPLE SPURIOUS MODES**  
J.M. Puder<sup>1</sup>, R.W. Rudy<sup>2</sup>, J.S. Pulskamp<sup>2</sup>, R.G. Polcawich<sup>2</sup>, and S.A. Bhave<sup>3</sup>  
<sup>1</sup>*Cornell University, USA*, <sup>2</sup>*US Army Research Laboratory, USA*, and <sup>3</sup>*Purdue University, USA*
- PW.02 **CMOS-MEMS RESONANT RF DEMODULATOR WITH SELF-ASSEMBLED NARROW TRANSDUCTION GAPS**  
M.E. Galanko and G.K. Fedder  
*Carnegie Mellon University, USA*
- PW.03 **EFFECTS OF SYNCHRONIZATION/HIGHER ORDER SYNCHRONIZATION ON THE FREQUENCY STABILITY OF MICROMECHANICAL OSCILLATORS**  
D. Pu<sup>1</sup>, R. Huan<sup>1</sup>, and X. Wei<sup>2</sup>  
<sup>1</sup>*Zhejiang University, CHINA* and <sup>2</sup>*Xi'an Jiaotong University, CHINA*

PW.04 **IMPACT OF ELECTROMECHANICAL NONLINEARITIES ON HIGH QUALITY FACTOR GYROSCOPES**

P. Taheri-Tehrani, M. Defoort, and D.A. Horsley  
*University of California, Davis, USA*

PW.05 **PIEZOELECTRIC TRANSFORMER SCALING STUDY USING RAPID ANALYTICAL-  
FEA TECHNIQUE**

R.Q. Rudy<sup>1</sup>, J.M. Puder<sup>2</sup>, S.S. Bedair<sup>1</sup>, J.S. Pulskamp<sup>1</sup>, and R.G. Polcawich<sup>1</sup>  
<sup>1</sup>*US Army Research Laboratory, USA* and <sup>2</sup>*Cornell University, USA*

### **Nonlinear and Non-Reciprocal Microsystems**

PW.06 **1:3 SYNCHRONIZATION IN A MICRO DISK RESONATOR**

P. Taheri-Tehrani<sup>1</sup>, A. Guerrieri<sup>2</sup>, M. Defoort<sup>1</sup>, A. Frangi<sup>2</sup>, and D.A. Horsley<sup>1</sup>  
<sup>1</sup>*University of California, Davis, USA* and <sup>2</sup>*Politecnico di Milano, ITALY*

PW.07 **ARE THIRD ORDER ELASTIC COEFFICIENTS THE DOMINANT FACTOR IN  
NONLINEAR ELASTIC BEHAVIOR OF SILICON-BASED RESONATORS?**

B. Khazaeili and R. Abdolvand  
*University of Central Florida, USA*

PW.08 **ELECTRONIC FEEDBACK-ENABLED MICRORESONATORS WITH INTENTIONAL  
NONLINEARITIES**

N. Bajaj, G. Chiu, and J.F. Rhoads  
*Purdue University, USA*

PW.09 **MAGNETIC-FREE RF MEMS CIRCULATORS**

M.M. Torunbalci, T. Odelberg, and S.A. Bhave  
*Purdue University, USA*

PW.10 **NONLINEARITY AND MODE COUPLING IN GRAPHENE  
NANOELECTROMECHANICAL RESONATORS**

P.X.-L. Feng  
*Case Western Reserve University, USA*

### **Parametric Resonance in the Optical, Mechanical and Acoustic Domains**

PW.11 **PARAMETRIC AND NONLINEAR PHENOMENA IN ALUMINUM NITRIDE MEMS  
RESONATORS**

M. Breen, R. Lu, A. Gao, and S. Gong  
*University of Illinois, USA*

### **Optomechanics**

PW.12 **A PHOTONIC MEMS ACCELEROMETER WITH A LOW-FINESSE HEMISPHERICAL  
MICROCAVITY**

Y. Bao, F. Zhou, T.W. LeBrun, and J.J. Gorman  
*National Institute of Standards and Technology (NIST), USA*

## **MEMS/NEMS Logic for Novel Computing Paradigms (Neuromorphic, Quantum, Physical)**

- PW.13      **DEMONSTRATION OF A NON-LINEAR MEMS RESONATORS NETWORK FOR RESERVOIR COMPUTING**  
S. Mejaouri, J.C. Coulombe, A. D'Arcy-Lepage, and J. Sylvestre  
*Université de Sherbrooke, CANADA*
- PW.14      **RESERVOIR COMPUTING WITH ARRAYS OF NON-LINEAR MEMS OSCILLATORS**  
J. Sylvestre, S. Mejaouri, J.C. Coulombe, and A. D'Arcy-Lepage  
*Université de Sherbrooke, CANADA*
- 11:50      **Lunch**
- 13:05      **Plenary Speaker IV**  
**TEMPORALLY-MODULATED MICROSYSTEMS ENABLE NEW WIRELESS COMMUNICATION PARADIGMS**  
Harish Krishnaswamy  
*Columbia University, USA*
- 14:05      **Invited Speaker VII**  
**NONRECIPROcity AND CHIRALITY IN OPTO-MECHANICAL RESONATORS**  
G. Bahl  
*University of Illinois, Urbana-Champaign, USA*
- 14:50      **Break**
- 15:10      **Invited Speaker VIII**  
**TIME VARYING ELECTROMAGNETIC DEVICES: BREAKING THE FUNDAMENTAL LIMITS OF PASSIVES**  
E. Wang  
*University of California, Los Angeles, USA*
- 15:55      **Invited Speaker IX**  
**PIEZOELECTRIC MEMS CIRCULATORS**  
M. Rinaldi  
*Northeastern University, USA*
- 16:40      **Closing Remarks**
- 17:00      **Workshop Adjourns**