



PRELIMINARY PROGRAM

EXECUTIVE COMMITTEE RESERVES THE RIGHT TO AMEND THE PROGRAM IF NECESSARY.

Monday, August 21

12:00 **Registration**

13:30 **Welcome Address**

Sunil Bhave, *Purdue University, USA*

David Horsley, *University of California, Davis, USA*

Afternoon Program Chair

S. Gong, *University of Illinois, Urbana–Champaign, 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 - **Wine & Cheese Welcome Reception**

19:15

Tuesday, August 22

Morning Program Chair

R. Candler, *University of California, Los Angeles, USA*

- 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. Miller¹, A. Ansari², D.B. Heinz¹, I.B. Flader¹, Y. Chen¹, D.D. Shin¹,
and T.W. Kenny¹
¹Stanford University, USA and ²California Institute of Technology, USA
- 11:15 **Invited Speaker III**
NONLINEAR MEMS FOR EXPLOSIVE DETECTION
J. Rhoads
Purdue University, USA
- 12:00 **Lunch**

Afternoon Program Chair
T. Kenny, *Stanford University, USA*

- 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. Zhou¹, D. Xiao¹, Q. Li¹, Z. Hou¹, K. He², Y. Wu¹, and X. Wu¹
¹*National University of Defense Technology, CHINA and*
²*East China Institute of Photo-Electronic IC, CHINA*
- PT.02 **ALUMINUM NITRIDE CROSS-SECTIONAL LAM^o-MODE RESONATORS WITH FIGURE-OF-MERIT >134 AND FREQUENCY TUNABILITY OF 70 MHZ/ μ 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 **INTERNAL RESONANCES OF A GEOMETRICALLY NONLINEAR MICROCANTILEVER-POLYMER SYSTEM**
K. Asadi¹, S. Peshin², J. Yeom², and H. Cho¹
¹*Ohio State University, USA and* ²*Michigan State University, USA*
- PT.05 **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.06 **1:3 SYNCHRONIZATION IN A MICRO DISK RESONATOR**
P. Taheri-Tehrani¹, A. Guerrieri², M. Defoort¹, A. Frangi², and D.A. Horsley¹
¹University of California, Davis, USA and ²Politecnico di Milano, ITALY
- 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. Yu¹, D. Sounas², C. Cassella¹, Z. Qian¹, A. Kord², A. Alu², and M. Rinaldi¹
¹Northeastern University, USA and ²University 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

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

Morning Program Chair

M. Judy, *Analog Devices, Inc., USA*

- 09:00 **Contributed Presentation III**
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. Puder¹, R.W. Rudy², J.S. Pulskamp², R.G. Polcawich², and S.A. Bhave³
¹*Cornell University, USA*, ²*US Army Research Laboratory, USA*, and
³*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. Pu¹, R. Huan¹, and X. Wei²
¹*Zhejiang University, CHINA* and ²*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. Rudy¹, J.M. Puder², S.S. Bedair¹, J.S. Pulskamp¹, and R.G. Polcawich¹
¹*US Army Research Laboratory, USA* and ²*Cornell University, USA*

Nonlinear and Non-Reciprocal Microsystems

PW.06 **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.07 **ELECTRONIC FEEDBACK-ENABLED MICRORESONATORS WITH INTENTIONAL
NONLINEARITIES**

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

PW.08 **MAGNETIC-FREE RF MEMS CIRCULATORS**

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

PW.09 **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.10 **PARAMETRIC AND NONLINEAR PHENOMENA IN ALUMINUM NITRIDE MEMS
RESONATORS**

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

Optomechanics

PW.11 **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.12 **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.13 **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
- PW.14 **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
- 11:50 **Lunch**
- Afternoon Program Chair**
B. Kim, *TDK Invensense, USA*
- 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**