

# MUT2019 - Workshop Program

Tuesday June 11<sup>th</sup>, 2019

8:30	<b>Registration</b>
9:00	<b>Welcome</b> : <i>Caroline Coutier, CEA LETI, France</i>
<b>PART 1 - NEW APPLICATIONS – CHAIR : Levent Degertekin</b>	
9:15	<b>Invited speaker:</b> <i>Sheng Xu - University of California, USA</i> <b>Soft ultrasonic devices for continuous health monitoring: from the skin to below the skin</b>
9:45	<i>Roger Zemp, Eric Dew, Afshin Kashani Ilkhechi, Dylan Ma, Zhenhao Li &amp; Mohammad Maadi - University of Alberta, USA</i> <b>Transparent, Charging-Free and Flexible CMUT Arrays for Next-Generation Photoacoustic and Ultrasound Imaging Applications</b>
10:05	<i>Anne Ghis, Lucie Le Van-Jodin, François Frassati, Matthieu Matringe, Octavia Ndjoye-Kogou &amp; François Blard – Univ. Grenoble Alpes, CEA LETI, France</i> <b>Ultrathin and flexible carbon membranes for high density ultrasound MEMS arrays</b>
10:25	<b>Break</b>
<b>PART 2 – MARKET – CHAIR : Jean-Philippe Polizzi</b>	
11:00	<i>Marjorie Villien - Yole Développement, France</i> <b>Micro-machined ultrasonic transducers are coming to market: why now?</b>
11:20	<i>Rob van Schaijk<sup>1</sup>, Pieter Robaey<sup>1</sup>, Harold Roosen<sup>1</sup>, Johan Klootwijk<sup>2</sup>, Chris van Heesch<sup>2</sup>, Peter Dirksen<sup>2</sup> &amp; Sara Leggese<sup>1</sup> - <sup>1</sup>Philips Innovation Services &amp; <sup>2</sup>Philips Research, Netherlands</i> <b>CMUT: a versatile and low cost ultrasonic platform</b>
<b>PART 3 – OTHER APPLICATIONS – CHAIR : Dominique Certon</b>	
11:40	<i>Ahmad Rezvanitabar, Evren F. Arkan &amp; F. Levent Degertekin - Georgia Institute of Technology, USA</i> <b>Broadband Impedance Matching with Negative Capacitance for Capacitive Micromachined Ultrasonic Transducers (CMUTs)</b>
12:00	<i>Baris Bayram<sup>1</sup>, Goktug Cihan Ozmen<sup>1</sup>, Ekin Muharrem Karaca<sup>1</sup>, Anil Bozyigit<sup>1</sup>, Murat Arslan<sup>1</sup>, Irem Kozakci<sup>1</sup>, Eda Begum Berberoglu<sup>1</sup>, Tansu Demerci<sup>1</sup>, Berkay Karacaer<sup>1</sup> &amp; Asaf Behzat Sahin<sup>2</sup> - <sup>1</sup>Middle East Technical University &amp; <sup>2</sup>Yildirim Beyazit University, Turkey</i> <b>Development and Characterization of Capacitive Micromachined Ultrasonics Transducers as a Microphone</b>
12:20	<i>Farah Memon, Junyi Wang, Gerard Touma, Spyridon Baltsavias, Morten Fischer Rasmussen, A. Sanli Ergun, Eric Olcott, R. Brooke Jeffrey, Amin Arbabian &amp; Butrus (Pierre) T. Khuri-Yakub - Stanford University, USA</i> <b>Flexible Capacitive Micromachined Ultrasonic Transducer (CMUT) Arrays for Capsule Ultrasound (CUS) Device</b>
12:40	<b>Lunch</b>

**PART 4 – GAS SENSING – CHAIR : Bruno Fain**

- 14:30 *Dovydas Barauskas, Donatas Pelenis, Gailius Vanagas and Darius Viržonis; Kaunas University of Technology, Panevėžys Institute of Technologies and Business, Panevėžys, Daukanto st. 30*  
**mPEI functionalized Capacitive Micromachined Ultrasound Transducer for CO<sub>2</sub> and SO<sub>2</sub> gas detection**
- 14:50 *Luis IGLESIAS<sup>1</sup>, Priyadarshini SHANMUGAM<sup>2</sup>, Steven PENA<sup>1</sup>, Jean-François MICHAUD<sup>2</sup>, Daniel ALQUIER<sup>2</sup>, Laurent COLIN<sup>2</sup>, Dominique CERTON<sup>2</sup> & Isabelle DUFOUR<sup>1</sup>- <sup>1</sup>Université de Bordeaux, Laboratoire IMS UMR-CNRS 5218, <sup>2</sup> Université de TOURS, GREMAN UMR-CNRS 7347*  
**Gas detection in binary mixture by time of flight measurement made by the use of CMUTs**

**PART 5 – FABRICATION – Alessandro Savoia**

- 15:10 *A. Havreland, M. Engholm, M. Petersen & E. V. Thomsen - Technical University of Denmark*  
**CMUTs made by a Poly-Silicon-on-Insulator wafer**
- 15:30 *A. Atalar, H. Koymen, M. Yilmaz, K. Enhos, I. Koymen, S. Tasdelen - Bilkent University, TURKEY*  
**A CMUT Microphone Fabricated using a CMOS Process**
- 15:50 **Break**

**PART 6 – CHARACTERIZATION – CHAIR : Abdullah Atalar**

- 16:10 *Andreas Spandet Havreland, Mathias Engholm, Kasper Fløng Pedersen & Erik Vilain Thomsen - Technical University of Denmark, Denmark*  
**Optimal Estimation of Resonance Frequency, Bandwidth, and Output Pressure for Ultrasound Transducers**
- 16:30 *Kerem Enhos, A. Sinan Tasdelen, Mehmet Yilmaz, Abdullah Atalar and Hayrettin Koymen - Bilkent University, Turkey*  
**Transmitting CMUT Arrays without a DC Bias**
- 16:50 *Erik Vilain Thomsen, Andreas Havreland, Mads Alexander Weile, Martin Lind Ommen & Mathias Engholm – Technical University of Denmark, Denmark*  
**Wafer Level Characterization of Row-Column Addressed CMUT Arrays**

**PART 7 – SPONSOR – CHAIR : Caroline Coutier**

- 17:10 *Bruno Ghyselen - SOITEC, France*  
**Advanced SOI wafers and wafer bonding, layer transfer techniques for manufacturing of high quality MUTs**
- 17:30 **End of the first day**
- 20:00 **Gala dinner - Restaurant O2 Téléphérique**

Wednesday June 12<sup>th</sup>, 2019

**PART 1 – LOW FREQUENCY DEVICES – CHAIR : Bruno Ghyselen**

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| 8:30 | <i>B. Ma, K. Firouzi, and K. Brenner &amp; B. T. Khuri-Yakub - Stanford University, USA</i><br><b>High-Sensitivity and Wide-Bandwidth Airborne CMUTs with Low Driving Voltage</b>   |
| 8:50 | <i>Evren F. Arkan &amp; F. Levent Degertekin - Georgia Institute of Technology, USA</i><br><b>Frequency Response Limiting Factors for Low Frequency, Single Element CMUTs in Non-collapsed Mode</b>   |
| 9:10 | <i>J. Jung, J.-C. Bastien, R. Dejaeger, A. Lefevre, O. Ndjaye-Kogou, F. Blard &amp; B. Fain - Univ. Grenoble Alpes, CEA LETI – France</i><br><b>AlN-based bimorph piezoelectric micromachined ultrasound transducer for air-borne application below 100 kHz</b> |

**PART 2 – SPONSORS – CHAIR: Caroline Coutier**

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| 9:30  | <i>Yves Emery, Jérôme Parent &amp; Etienne Cuche - Lyncée Tec SA, Switzerland</i><br><b>New Digital Holography Microscopes (DHM®) measurements and modalities for dynamical measurements</b> |
| 9 :50 | <i>Florent Deux, Polytec France SAS, Markus Heilig, Polytec GmbH</i><br><b>Latest technologies for the dynamic and static characterization of micro-structures</b>                           |
| 10:10 | <b>Break</b>   |

**PART 3 – MEDICAL APPLICATIONS – CHAIR : B. T. Khuri-Yakub**

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| 10:40 | <i>A. Ganeau<sup>1</sup>, A. Nguyen<sup>1</sup>, L. Daunizeau<sup>1</sup>, C. Bawiec<sup>1</sup>, N. Guillen<sup>2</sup>, N. Sénégon<sup>3</sup>, W.A. N'Djin<sup>1</sup> &amp; J.Y. Chapelon<sup>1</sup> - <sup>1</sup>Université Lyon 1, <sup>2</sup>EDAP TMS &amp; <sup>3</sup>Vermon</i><br><b>Endocavitary CMUT probe for ultrasound-guided high intensity focused ultrasound therapy</b>     |
| 11:00 | <i>J. Oevermann<sup>1</sup>, M. Cordelair<sup>2</sup>, F. Tiefensee<sup>1</sup>, N. Hoffmann<sup>2</sup>, P. Weber<sup>1</sup>, J. Koblitz<sup>2</sup> &amp; S. Tretbar<sup>1</sup></i><br><i>Fraunhofer Institute for Biomedical Engineering &amp; microfab Service GmbH, Germany</i><br><b>Design of miniaturized capacitive ultrasonic transducers (CMUTs) for intracorporeal communication</b> |

**PART 4 – MODELLING – CHAIR : Erik Vilain Thomsen**

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| 11:20  | <i>Marcel Krenkel<sup>1</sup>, Sandro Koch<sup>1</sup> &amp; Mario Kupnik<sup>2</sup> - <sup>1</sup>Fraunhofer Institute of Photonic Microsystems &amp; <sup>2</sup>Technische Universität Darmstadt, Germany</i><br><b>CMUT with mechanically coupled plate actuators – Linearized electrostatic modeling</b> |
| 11:40  | <i>Bernard Shieh &amp; Eleanor Stride - University of Oxford, UK</i><br><b>Progress towards a full array non-linear CMUT model using FE-BEM and Hierarchical Matrices</b>  |
| 12:00  | <b>Lunch</b>   |
| 14:15  | <b>Social event – Bus departure for « Le Château du Touvet »</b>   |
| 18 :00 | <b>Closing of the workshop</b>   |