# PowerMEMS 2024+

## MINIATURE ENERGY SYSTEMS

18–21 NOVEMBER 2024 • Tønsberg, NORWAY

# Program

**Conference Chair:**
Einar Halvorsen
University of South-Eastern Norway, NORWAY

**Technical Program Chair:**
Hamed Salmani
University of South-Eastern Norway, NORWAY

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# TECHNICAL PROGRAM INFORMATION

**Guide to Understanding Paper Numbering**
Each paper in the technical program is assigned a unique number (**T1A-03)** which indicates when the paper is presented. The number of each paper is shown before the paper title.

The first letter (i.e. **T**) indicates the day of the Conference:
T = Tuesday W = Wednesday Th = Thursday

The second number (i.e., **1**) indicates the session

The **third** letter (i.e., **A**) indicates which room the session is held in:
A = Ormen 1&2 B = Ormen 3

The fourth number (i.e. 04) indicates the number of the paper in the session.

**Guide to Understanding Poster Numbering**
Each poster is also assigned a unique number (**P01a**).

The numeric characters (i.e., **01**) is the poster position.

The last character (i.e., **a**) shows the classification of the poster.
**a** - Biochemical and Bio-Inspired Power/Energy Systems
**b** - Energy Harvesting and Power Transfer (Mechanical, Thermal, Solar, Bio, Triboelectric, RF, Acoustic, etc.)
**c** - General Energy Conversion and Transfer
**d** - Implantable or Wearable Devices and Miniature Energy Systems
**e** - Materials for Miniature Energy Systems
**f** - Power Transfer
**g** - Ultra-Low- Power Sensors and Systems

# Monday, 18 November

All indicated times are Central European Time (CET).

**09:00** **PowerMEMS School**

**16:50** Auditorium A1-32 Sandefjord USN Campus Vestfold

09:00 - 10:00

**Device/Circuit**
Adrien Badel
Université Savoie Mont Blanc, FRANCE

10:05 - 11:05

**Triboelectrics**
Philippe Basset
ESIEE Paris, FRANCE

11:10 - 12:10

**Wearables and Systems**
Shad Roundy
University of Utah, USA

**12:10** **Lunch**

13:40 - 14:40

**Electret-Based Energy Harvester/ AI-Related Technology/ International Standardization**
Yuji Suzuki
University of Tokyo, JAPAN

14:45 - 15:45

**Storage**
Xiaohong Wang
Tsinghua University, CHINA

15:50 - 16:50

Ryoto Yanagisawa
University of Tokyo, JAPAN

# Tuesday, 19 November

All indicated times are Central European Time (CET).

**08:45** **Conference Welcome**

Ormen 1&2

**Conference Chair:**
Einar Halvorsen, *University of South-Eastern Norway, NORWAY*

**09:00** **Plenary Presentation I**

Chair: Einar Halvorsen, University of South-Eastern Norway, NORWAY

**TPA-1** **POWER MEMS AND SILICON PHOTONICS – AN ENABLING COMBINATION**
Olav Solgaard
Stanford University, USA

**10:00** **Session T1A - Energy Harvesting and Power Transfer I**

Chair: Sebastian Bader, Mid Sweden University, SWEDEN

10:00 - 10:20

**T1A-1** **WIRELESS ELECTRODYNAMIC POWER TRANSFER: MODELING AND DISCUSSION OF A DUAL-MODE RECEIVER**
Adrien Ameye[1], Adrien Morel[1], Rémi Recoquillé[1,2], Nicolas Garraud[2], Pierre Gasnier[2] and Adrien Badel[1]
[1]Université Savoie Mont Blanc, FRANCE and
[2]CEA Leti, FRANCE

10:20 – 10:40

**T1A-2** **OPTIMISING THE ELECTRODE CONFIGURATION TO MAXIMISE THE POWER OUTPUT OF DROPLET TRIBOELECTRIC NANOGENERATORS**
Oliver Prendergast, Giulio Fatti, Andrew Holmes and Tom Reddyhoff
Imperial College London, UK

10:40 – 11:00

**T1A-3** **DEVELOPMENT OF DETACHABLE TRIBOELECTRIC NANOGENERATOR FOR TIRES**
Hiroshi Tani, Shohei Kawada, Renguo Lu, and Shinji Koganezawa[1]
Kansai University, JAPAN

11:00 – 11:20

**T1A-4** **ELECTROMECHANICAL COUPLING COEFFICIENT: NEW APPROACH TO STUDY AUXETIC PIEZOELECTRIC HARVESTERS**
Grégoire Forges[1,2], David Gibus[1], Adrien Morel[1], Adrien Badel[1], and Hélène Debéda[2]
[1]Université Savoie Mont-Blanc, FRANCE and
[2]Université de Bordeaux, FRANCE

**11:30** **Refreshment Break**
Lobby

| **Session T2A**<br>**Energy Harvesting and Power Transfer II** | **Session T2B**<br>**Materials and Fabrication I** |
|---|---|
| Chair: Hiroyuki Mitsuya, Saginomiya Seisakusho, Inc., JAPAN | Chair: Fei Wang, Southern University of Science and Technology, CHINA |
| 12:00 - 12:20 | |
| **T2A-1**<br>**ELECTRET-BASED WIND ENERGY HARVESTER WITH ULTRA-LOW CUT-IN VELOCITY**<br>Tomoya Miyoshi[1], Jiaming Yao[1], Quentin Bruiant[2], and Yuji Suzuki[1]<br>[1]University of Tokyo, JAPAN and [2]Université Savoie Mont Blanc, France | **T2B-1**<br>**WAFER-SCALE FABRICATION OF MESOPOROUS TUNGSTEN-BASED MICRO-SUPERCAPACITORS WITH HIGHLY ORIENTED NANOSTRUCTURE**<br>Jiyong Zhou[1], Jianyou Dai[1], Zhanpeng Shi[1], Yier Xia[2], Minghao Xu[2], Lei Shan[1], Xiaohong Wang[2], and Sixing Xu[1]<br>[1]Hunan University, CHINA and [2]Tsinghua University, CHINA |

| 12:20 – 12:40 | |
|---|---|
| **T2A-2**<br>**ELECTRICAL CHARACTERIZATION AND MODELLING OF AN ULTRASOUND-POWERED TRIBOELECTRIC GENERATOR FOR IMPLANTABLE APPLICATIONS**<br>Thomas Baudin[1], Armine Karami[1], Dabin Kim[2], Sera Jeon[2], Dimitri Galayko[3], Jean-Marc Laheurte[1], Sang-Woo Kim[2], and Philippe Basset[1]<br>[1]Université Gustave Eiffel, FRANCE, [2]Yonsei University, KOREA, and [3]Sorbonne Université, FRANCE | **T2B-2**<br>**INVESTIGATION OF STRUCTURE AND BANDGAP DEPENDENCE OF INGAAS SOLAR CELL DESIGN FOR THERMOPHOTOVOLTAIC APPLICATIONS**<br>Xinyi Ma, Shipei Zhang, Shengyu Sun, and Xiawa Wang<br>Duke Kunshan University, CHINA |
| 12:40 – 13:00 | |
| **T2A-3**<br>**AN EFFICIENT ACOUSTIC POWER TRANSFER USING A SELF-BIASED ELECTROSTATIC MEMS TRANSDUCER**<br>Paul Roche[1], Kevin Nadaud[1], Dimitri Galayko[2], Samuel Callé[1], Jean-Charles Lebunetel[1], Dominique Certon[1], and Guylaine Poulin-Vittrant[1]<br>[1]University of Tours, CNRS, INSA CVL, FRANCE and [2]Sorbonne University, CNRS, FRANCE | **T2B-3**<br>**CHARACTERIZATION AND OPTIMIZATION OF LIGHTWEIGHT FOAMED PLA CANTILEVERS FOR LOW-VACUUM ENERGY HARVESTING APPLICATIONS**<br>Giacomo Clementi[1], Francesco Bonacci[1], Silvia Caponi[2], Francesco Cottone[1], Alessandro Di Michele[1], Luca Gammaitoni[1], Maurizio Mattarelli[1], Valentin D. Paccoia[1], Gabriele Perna[1], Flavio Travasso[3], and Igor Neri[1]<br>[1]University of Perugia, ITALY, [2]IOM-CNR, ITALY, and [3]University of Camerino, ITALY |

**13:00** **Lunch**

Restaurant Lindahl

| Session T3A<br>Energy Harvesting and Power Transfer III | Session T3B<br>Biochemical and Bio-Inspired Power/Energy Systems & Applications and Innovations in Micro Energy |
|---|---|
| Chair: Xiaohong Wang,<br>Tsinghua University, CHINA | Chair: Yuji Suzuki,<br>University of Tokyo, JAPAN |
| 14:30 – 14:50 | |
| **T3A-1**<br>**IN-EAR THERMAL POWER CAPABILITY AND THERMOELECTRIC ENERGY HARVESTING APPROACHES**<br>Tigran Avetissian[1], David Niederhauser[1], Léa Grima[1], Aidin Delnavaz[1], Adrien Morel[2], Adrien Badel[2], and Jérémie Voix[1]<br>[1]École de Technologie Supérieure, CANADA and [2]Université Savoie Mont Blanc, FRANCE | **T3B-1**<br>**SELF-POWERED ELECTRIC FIELD SENSOR BASED ON DROPLET ELECTRICITY GENERATOR**<br>Jiaxing Xu[1], Ling Bu[1], and Xiaohong Wang[2]<br>[1]China University of Geosciences, CHINA and [2]Tsinghua University, CHINA |
| 14:50 – 15:10 | |
| **T3A-2**<br>**MULTI-PHASE VARIABLE RELUCTANCE ENERGY HARVESTER FOR SMART BEARING HUB UNITS**<br>Mengfei Wu, Ye Xu, and Sebastian Bader<br>Mid Sweden University, SWEDEN | **T3B-2**<br>**SELF-POWERED LIVING SENSOR DISPLAY IMPLANTED ON SKIN FOR LONG-TERM BIOMARKER MONITORING**<br>Jun Sawayama[1], Yuki Takayama[1,3], Shogo Nagata[1], Hoshimi Aoyagi[1], Aki Takimoto[1], Miki Takase[2], Miho Ogawa[2], Makoto Takeo[2], Koji Yano[3], Shoji Takeuchi[1], Takashi Tsuji[2], and Hiroyuki Fujita[3,4]<br>[1]University of Tokyo, JAPAN, [2]Riken, JAPAN, [3]Canon Medical Systems Co., JAPAN, and [4]Tokyo City University, JAPAN |

| 15:10 – 15:30 | |
|---|---|
| **T3A-3**<br>**A CONTACTLESS MAGNETIC FREQUENCY-BOOSTING MECHANISM FOR WIND ENERGY HARVESTING**<br>Yunfei Li[1,2], Manjuan Huang[2], Tianyi Tang[1,2], Heng Zhao[2], Lining Sun[1,2], and Huicong Liu[2]<br>[1]Harbin Institute of Technology, CHINA and [2]Soochow University, CHINA | **T3B-3**<br>**A POWER SIMULATION TOOL FOR THE OPTIMIZATION OF WIRELESS SENSOR NODES**<br>Prateek Asthana[1], Mario Costanza[1], Eoin Ahern[1], John Flannery[1], Paul Geoghegan[2], Andrea Ingenito[3], and Mike Hayes[1]<br>[1]Tyndall National Institute, IRELAND, [2]NetFeasa, IRELAND, and [3]CSEM, SWITZERLAND |

**15:30** **Refreshment Break**

Lobby

**16:00** **Poster Session**

Ormen 1&2

## a - Biochemical and Bio-Inspired Power/Energy Systems

**P01a** **A SCALABLE AND FLEXIBLE TWISTED YARN BIOFLUID-ACTIVATED BATTERIES FOR ENERGY SYSTEMS**
Sheng Yong, Jidong Liu, Stephen Beeby
University of Southampton, UK

**P02a** **INCLINED-LEGS ACTUATOR INSPIRED BY SETARIA VIRIDIS**
Shinji Koganezawa, Takaaki Ichien, Hotaka Tsuboi, Hiroshi Tani, Renguo Lu, and Shouhei Kawada
Kansai University, JAPAN

## b - Energy Harvesting and Power Transfer (Mechanical, Thermal, Solar, Bio, Triboelectric, RF, Acoustic, etc.)

**P03b** **A MAGNETIC SOFTENING RESONATOR WITH FLAT POWER GENERATION FOR NONLINEAR VIBRATION ENERGY HARVESTING**
Taiga Yanase, Yu Yoshida, Motoaki Hiraga, Nanako Miura and Arata Masuda
Kyoto Institute of Technology, JAPAN

**P04b** **A PRECISION MEASUREMENT SYSTEM FOR TRIBOELECTRIC MATERIALS**
Björn N. Ewald, Peter Woias and Uwe Pelz
University of Freiburg, GERMANY

**P05b** **AN ANALYTICAL SOLUTION FOR PIEZOELECTRIC ENERGY HARVESTER BEAMS WITH LINEARLY VARYING CROSS SECTION**
S.A. Hosseini Kordkheili[1], Hadis Naghian[1], and Hamed Salmani[2]
[1]Sharif University of Technology, IRAN and
[2]University of South-Eastern Norway, NORWAY

**P07b** **COIL VIBRATION TYPE ELECTROMAGNETIC ENERGY HARVESTER FOR VEHICLE VIBRATION ENERGY HARVESTING**
Dae-Sung Kwon, Ilseon Yoo, Sanghyeok Yang,
and Hyunsoo Kim
Hyundai Motor Company, KOREA

**P08b** **CREATING THERMALLY STABLE P-TYPE CARBON NANOTUBES VIA COORDINATION CHEMISTRY FOR THERMOELECTRIC MATERIALS**
Kaho Kawasaki[1], Yasuko Koshiba[1], Kouki Akaike[2], Qingshuo Wei[2,3], Masahiro Funahashi[1], Kenji Ishida[1,4], and Shohei Horike[1,2]
[1]Kobe University, JAPAN, [2]National Institute of Advanced Industrial Science and Technology, JAPAN, [3]University of Tsukuba, JAPAN, and [4]Kyushu University, JAPAN

**P09b** **DEVELOPMENT OF LOW FREQUENCY HYBRID HARVESTER FOR VEHICLE VIBRATION ENERGY HARVESTING**
Ilseon Yoo, Dae-Sung Kwon, Sanghyeok Yang
and Hyunsoo Kim
Hyundai Motor Company, KOREA

**P10b** **LARGE FREQUENCY RANGE ELECTRODYNAMIC HARVESTER BASED ON FREQUENCY-UP RESONANT CONVERTER FOR ROTATIONAL MOVEMENTS**
Pierre Gasnier[1], Corentin Bréal[1], Andy Falda[1], Baptiste Alessandri[2], Sébastien Boisseau[1] and Nicolas Garraud[1]
[1]CEA-Leti, University Grenoble Alpes, FRANCE and [2]DAVIDSON, FRANCE

**P11b** **PERFORMANCE ENHANCEMENT OF DROPLET-BASED ELECTRICITY GENERATORS USING ROTARY MECHANISMS**
Shanghao Gu, Guangxia Lui, Weihan Xu and Fei Wang
Southern University of Science and Technology, CHINA

**P12b** **THERMOELECTRICITY TO POWER WIRELESS SENSORS: AN INDUSTRIAL APPLICATION.**
Vincent Boitier[1], Lionel Seguier[1], Bruno Estibals[1], Clement Arnaud[2], Thibault Anfrie[2], and Cedric Maurin[2]
[1]Université de Toulouse, CNRS, UPS, FRANCE and [2]Arcelor Mittal, Fos Sur Mer, FRANCE

**P13b** **TIRE PRESSURE MONITORING SYSTEM (TPMS): RECENT ADVANCEMENT AND POTENTIAL ENERGY HARVESTING SOLUTIONS**
Félix Barkoum Betra[1,2], Vincent Boitier[1], and Amine Defous[2]
[1]RD EE TIS Team Continental, FRANCE and [2]University de Toulouse, CNRS, UPS, FRANCE

## c - General Energy Conversion and Transfer

**P14c** **IMPACT-INDUCED FREQUENCY UP-CONVERSION VIBRATION ENERGY HARVESTER BASED ON METAL-SUBSTRATE PIEZOELECTRIC THICK FILM**
Kaijun Lin[1], Manjuan Huang[1], Xiaowei Feng[1], Zhenming Li[2], Wei Liu[2], and Huicong Liu[1]
[1]Soochow University, CHINA and [2]China Electric Power Research Institute, CHINA

## d - Implantable or Wearable Devices and Miniature Energy Systems

**P15d** **DEVELOPMENT OF MICRO-STRUCTURAL WASTE HEAT UTILIZED POWER GENERATOR WITH SILICON AND REFRIGERANT**
Minami Kaneko, Kenji Kofu, and Fumio Uchikoba
Nihon University, JAPAN

## e - Materials for Miniature Energy Systems

**P17e** **ENHANCED ENERGY HARVESTING IN PVDF/ZNO NANOGENERATORS: A COMPARATIVE INVESTIGATION OF FABRICATION METHODS**
Md. Jahirul Islam, Hyeji Lee, Jinseo Ha, Subin Lee, Songsu Kim, Young-Gun Kwon, Wolyoung Kim, Seokyu Kim, Kihak Lee and Bonghwan Kim
Daegu Catholic University, KOREA

## f - Power Transfer

**P18f** **BISTABLE ELECTROMECHANICAL RECEIVER FOR ULTRA-LOW FREQUENCY WIRELESS POWER TRANSFER**
Léo-Scott Macke[1], Adrien Morel[1], Aya Benhemou[1], Timotéo Payre[2], Luc Marechal[1]and Ludovic Charleux[1]
[1]Université Savoie Mont Blanc, FRANCE and
[2]Cedrat Technologies, France

**P19f** **COMPARATIVE ANALYSIS OF CLASS-E AND CLASS-Φ2 INVERTERS FOR 13.56 MHZ WIRELESS POWER TRANSFER SYSTEMS**
Hieu L.Q. Nguyen, Nathis Côte, Nicolas Garraud, Léo Sterna and Sébastien Boisseau
CEA-Leti, FRANCE

## g – Ultra-Low- Power Sensors and Systems

**P20g** **MODAL SHIFT CHARACTERIZATION OF LINBO3 THICK-FILM SURFACE ACOUSTIC WAVE TEMPERATURE SENSOR**
Yukang Shi[1], Ling Bu[1] and Xiaohong Wang[2]
[1]China University of Gensciences, CHINA and
[2]Tsinghua University, CHINA

| Session T4A<br>Energy Harvesting and Power Transfer IV | Session T4B<br>Energy Conversion and Power Transfer |
|---|---|
| Chair: Takayuki Fujita, University of Hyogo, JAPAN | Chair: Adrien Morel, Savoie Mont Blanc University, FRANCE |
| 17:00 – 17:20 | |
| **T4A-1**<br>**FIVE-TERMINAL DUAL-POLARITY MEMS ELECTROSTATIC TRANSDUCER FOR NEAR-LIMITS KINETIC ENERGY HARVESTING FROM IRREGULAR VIBRATIONS**<br>Moein Rahmani[1], Armine Karami[1], Francisco Ambia[2], Alexis Brenes[2], Dimitri Galayko[3], Elie Lefeuvre[2] and Philippe Basset[1]<br>[1]Université Gustave Eiffel, FRANCE, [2]University Paris Saclay, FRANCE, and [3]Sorbonne Université, FRANCE | **T4B-1**<br>**MULTI-COIL-BASED INDUCTIVE POWER TRANSFER SYSTEM FOR IN-SITU SOIL SENSING APPLICATION**<br>Sheng Ding[1], John Sanchez[1], Shad Roundy[1], Ramesh Goel[1], Cody Zesiger[2], and Darrin Young[1]<br>[1]University of Utah, USA and [2]Utah State University, USA |
| 17:20 – 17:40 | |
| **T4A-2**<br>**INVESTIGATING THE EFFECT OF SURFACE TOPOLOGY MODIFICATIONS ON THE OUTPUT PERFORMANCE OF TENGS USING A STANDARDIZED SET-UP**<br>Fiza Asif and Peter Woias<br>University of Freiburg, GERMANY | **T4B-2**<br>**HIGH EFFICIENCY 2.496 GHZ CLASS E POWER AMPLIFIER FOR SPACE BASED SOLAR POWER APPLICATIONS**<br>Nunzio Pucci[1], Martin Prusa[1], Vladimir Marinov[1], Hossein Mardani[2], Neil Buchanan[2], and Paul D. Mitcheson[1]<br>[1]Imperial College London, UK and [2]Queen's University Belfast, UK |

| 17:40 – 18:00 | |
|---|---|
| **T4A-3**<br>**A WAVE ENERGY HARVESTER WITH VERTICAL PENDULUM AND MAG-BOOST MECHANISM**<br>Tianyi Tang[1,2], Yunfei Li[1,2], Heng Zhao[2], Lining Sun[1,2] and Huicong Liu[2]<br>[1]Harbin Institute of Technology, CHINA and<br>[2]Soochow University, CHINA | **T4B-3**<br>**A COMPARISON OF CURRENT-CARRYING COIL VERSUS ROTATING MAGNET TRANSMITTER FOR ELECTRODYNAMIC WIRELESS POWER TRANSMISSION**<br>Vernon S. Crasto and David P. Arnold<br>University of Florida, USA |
| 18:00 – 18:20 | |
| **T4A-4**<br>**GRADED MICRO-RESONATORS FOR ENHANCED SENSING AND ENERGY HARVESTING IN MEMS WITH LEAD-FREE PIEZOELECTRIC MATERIALS**<br>Jacopo M. De Ponti[1], Luca Iorio[1], Michele Rosso[1], Federico Maspero[1], Annachiara Esposito[2], Tarek Afifi Afifi[2], Manuel Riani[2], Gabriele Gattere[2], Andrea Di Matteo[2], Alberto Corigliano[1] and Raffaele Ardito[1]<br>[1]Politecnico di Milano, ITALY and<br>[2]STMicroelectronics, ITALY | **T4B-4**<br>**OPTIMIZATION OF AN ELECTROMAGNETIC HALBACH ARRAY FOR WIRELESS POWER TRANSFER**<br>Dibin Zhu[1], Xianghe Luo[1], and Tamuno-Omie Gogo[2]<br>[1]Shanghai Jiao Tong University, CHINA and<br>[2]University of Exeter, UK |

**18:20 Adjourn for the day**

# Wednesday, 20 November

All indicated times are Central European Time (CET).

**08:50** **Conference Announcements**

**09:00** **Plenary Presentation II**

Chair: Daisuke Yamane, Ritsumeikan University, JAPAN

**WPA-1** **PRACTICAL USE OF MEMS VIBRATIONAL ENERGY HARVESTER BASED ON SOLID ION ELECTRET**
Hiroyuki Mitsuya
Saginomiya Seisakusho, Inc., JAPAN

**10:00** **Session W5A - Energy Harvesting and Power Transfer V**

Chair: Sixing Xu, Hunan University, CHINA

10:00 – 10:20

**W5A-1** **FULLY 3D-PRINTED ROTATIONAL ENERGY HARVESTER BASED ON BIPOLAR CHARGED PLA ELECTRETS**
Dennis Flachs[1], Levin Bernhard[1], Sergey Zhukov[2], Heinz von Seggern[2], Alexander A. Altmann[2], Mario Kupnik[2], and Christiane Thielemann[1]
[1]Technische Hochschule Aschaffenburg, GERMANY and [2]Technische Universität Darmstadt, GERMANY

10:20 – 11:30

**W5A-2** **DESIGN OF MEMS VIBRATIONAL ENERGY HARVESTERS USING MICRO-CAVITY STRUCTURES WITH SELF-ASSEMBLED ELECTRETS**
Yuichiro Sunagawa[1], Ruichen Li[1], Kyoichi Kakuno[1], Satoru Hosoi[1], Ayato Jingu[2], Aoi Ito[2], Yuya Tanaka[2], and Daisuke Yamane[1]
[1]Ritsumeikan University, JAPAN and [2]Gunma University, JAPAN

12:40 – 13:00

**W5A-3** **CAM-DRIVEN FREQUENCY UP-CONVERSION MECHANISM FOR KINETIC ENERGY HARVESTING**
Heng Zhao[1], Tianyi Tang[1,2], Yunfei Li[1,2], Mingqi Mei[1] and Huicong Liu[1]
[1]Soochow University, CHINA and
[2]Harbin Institute of Technology, CHINA

**11:00** **Refreshment Break**
Lobby

| **Session W6A**<br>**Energy Harvesting and Power Transfer VI** | **Session W6B**<br>**Electrical Conditioning, Power Management and Energy Storage** |
|---|---|
| Chair: Daisuke Yamane, Ritsumeikan University, JAPAN | Chair: Adrien Badel, Université Savoie Mont Blanc, FRANCE |
| 11:30 – 11:50 | |
| **W6A-1**<br>**VIBRATION ENERGY CONVERTER WITH DOUBLE FREQUENCY-UP CONVERSION FOR ENHANCED SELF-POWERED HUMAN MOTION SENSING**<br>Guoliang Zhong[2], Riliang Li[2], Anxin Luo[2] and Fei Wang[1]<br>[1]Southern University of Science and Technology, CHINA and [2]Dongguan University of Technology, CHINA | **W6B-1**<br>**ON THE OPTIMAL CHOICE OF ELECTRICAL CONDITIONING CIRCUITS FOR TRIBOELECTRIC NANOGENERATORS**<br>Hachem Mortada[1], Armine Karami[1], Delaram Haghighi-Talab[1], Ahmad Delbani[1], Dimitri Galayko[2], and Philippe Basset[1]<br>[1]Université Gustave Eiffel, FRANCE and [2]Sorbonne Université, FRANCE |

| 11:50 – 12:10 | |
|---|---|
| **W6A-2**<br>**DOUBLE PENDULUM-BASED NONLINEAR ROTATIONAL ENERGY HARVESTING FROM LOW-FREQUENCY HUMAN MOTION FOR SELF-POWERED SENSING**<br>Ziyu Wang[1], Ze Wei[1], Haopeng Xie[1], Hailing Fu[1], Nikolaos Chrysochoidis[2], and Fang Deng[1]<br>[1]Beijing Institute of Technology, CHINA and [2]University of Patras, GREECE | **W6B-2**<br>**LOW SUPPORT-LOSS MINIATURIZED ROSEN TRANSFORMER ON 128° Y-CUT LITHIUM NIOBATE**<br>Justin R. Phelps and Reza Abdolvand<br>University of Central Florida, USA |
| 12:10 – 12:30 | |
| **W6A-3**<br>**DEMONSTRATION OF LOW FREQUENCY AND HIGH-POWER DENSITY ALN-BASED PIEZOELECTRIC VIBRATION ENERGY HARVESTERS USING HIGH DENSITY TUNGSTEN PROOF MASSES**<br>André Dompierre, Mostafa Keshavarzi, Amrid Amnache, and Luc G. Fréchette<br>Université de Sherbrooke, CANADA | **W6B-3**<br>**BOOST THE EFFICIENCY OF STEP-DOWN CONVERTORS WITH SWITCHING ORDER OPTIMIZATION IN POWER MANAGEMENT FOR HIGH-VOLTAGE ENERGY HARVESTERS**<br>Zerui Xu[1], Xiangyu Zhao[1], Ziyang Ou[1], Sixing Xu[2], and Xiaohong Wang[1]<br>[1]Tsinghua University, CHINA and [2]Hunan University, CHINA |
| 12:30 – 12:50 | |
| **W6A-4**<br>**HARVESTING OF KINETIC ENERGY OF THE DROPLETS BY MEMS DEVICE**<br>Hiroki Narita, Kensuke Kanda, and Kazusuke Maenaka<br>University of Hyogo, JAPAN | **W6B-4**<br>**POST-TREATMENT OF CARBON NANOTUBES BASED ELECTRODES TO REALIZE LOW SELF-DISCHARGE SUPERCAPACITORS**<br>Ulzhan Bassembek[1], Omar Saif[2], Diani Muhandiram[2], Raghunandan Ummethala[2], Nayereh Soltani[2], Per Ohlckers[2], and Pai Lu[1]<br>[1]University of South-Eastern Norway, NORWAY and [2]nanoCaps AS, NORWAY |

**13:00** **Lunch**

Restaurant Lindahl

| **Session W7A**<br>**Energy Harvesting and Power Transfer VII** | **W7B**<br>**Ultra-Low- Power Sensors and Systems** |
|---|---|
| Chair: Tomoya Miyoshi,<br>University of Tokyo, JAPAN | Chair: Yu Jia,<br>Aston University, UK |
| 14:30 – 14:50 | |
| **W7A-1**<br>**POTENTIAL-BASED DESIGN OF ELECTRET-DIELECTRIC ELASTOMER LAMINATED ENERGY HARVESTER**<br>Kenta Ichikawa, Seiya Fujino, Kenta Iitani, Wataru Hijikata, and Kohji Mitsubayashi<br>Institute of Science Tokyo, JAPAN | **W7B-1**<br>**ENHANCING SENSITIVITY USING FREQUENCY LOCALIZATION FACTOR IN GAS SENSOR ANTISYMMETRIC WEAKLY COUPLED RESONATORS**<br>Haythem Draoui[1], Zhengliang Fang[1], Stephanos Theodossiades[1], Antonio Di Buono[2], and Amal Z. Hajjaj[1]<br>[1]Loughborough University, UK and [2]National Nuclear Laboratory, UK |
| 14:50 – 15:10 | |
| **W7A-2**<br>**GRAVITY AND MAGNET-INDUCED BI-STABILITY FOR BROADBAND ROTATIONAL ENERGY HARVESTING**<br>Md Shamim Ahmed[1], Mark Longden[2], Xianghong Ma[1], and Yu Jia[1]<br>[1]Aston University, UK and [2]RL Automotive Ltd, UK | **W7B-2**<br>**POROUS SILICONE-BASED STRETCHABLE TRIBOELECTRIC NANOGENERATOR FOR WEARABLE SELF-POWERED BIOMOTION MONITORING**<br>Anamika Barua[1], Tamanna Yasmin[2], Kamaruzzaman[1], and S M Sohel Rana[1]<br>[1]Noakhali Science and Technology University, BANGLADESH and [2]Korea Institute of Science and Technology, KOREA |

| 15:10 – 15:30 | |
|---|---|
| **W7A-3**<br>**ELECTRODYNAMIC WIRELESS POWER TRANSFER USING ROTATING RESONANT RECEIVER WITH HIGHLY NONLINEAR BEHAVIOR**<br>Rémi Recoquillé[1,2], Nicolas Garraud[1], Pierre Gasnier[1], and Adrien Badel[2]<br>[1]CEA-Leti, FRANCE and [2]University Savoie Mont Blanc, FRANCE | |

**15:30** **Refreshment Break**

Lobby

| **Session W8A**<br>**Energy Harvesting and Power Transfer VIII** | **Session W8B**<br>**Materials and Fabrication II** |
|---|---|
| Chair: Ryoto Yanagisawa, University of Tokyo, JAPAN | Chair: Christophe Gissinger, Ecole Normale Superieure (ENS), FRANCE |
| 16:00 – 16:20 | |
| **W8A-1**<br>**A WRIST-WORN ELECTRET ENERGY HARVESTER ENHANCED BY INTERMITTENT SWITCHING TO THE MOTOR MODE**<br>Zehan Shi[1], Tomoya Miyoshi[1], Adrien Morel[2], Adrien Badel[2], and Yuji Suzuki[1]<br>[1]University of Tokyo, JAPAN and [2]University of Savoie Mont Blanc, FRANCE | **W8B-1**<br>**HIGH OUTPUT MICROGENERATOR USING MgHfAlN FILM**<br>Hiroki Kuwano[1,2], Hung H. Nguyen[1,2], Le V. Minh[1], and Yosuke Takayama[1,2]<br>[1]Tohoku University, JAPAN and [2]Sendai Smart Machines, JAPAN |

| 16:20 – 16:40 | |
|---|---|
| **W8A-2**<br>**CHALLENGES IN PRINTING AND SHAPING SOFT MAGNETIC FLUX GUIDES**<br>Steven W. Wright[1],<br>Michail E. Kiziroglou[1,2], and Eric M. Yeatman[1]<br>[1]Imperial College London, UK<br>[2]International Hellenic University, Greece | **W8B-2**<br>**3D-PRINTED SOFT MAGNETIC CORES FOR COMPACT ELECTROMECHANICAL DEVICES VIA MATERIAL EXTRUSION**<br>Jorge Cañada[1], Steven F. Nagle[1], Neus Vidal[2], José M. López-Villegas[2] and Luis F. Velásquez-García[1]<br>[1]Massachusetts Institute of Technology, USA and [2]University of Bacelona, SPAIN |
| 16:40 – 17:00 | |
| **W8A-3**<br>**TUNING NON-LINEARITY IN CASCADED TAPERED SPRING TOPOLOGIES OF EM-VEHS WITH ENHANCED FIGURE OF MERIT**<br>Karan Roy[1,2], Andreas Amann[2], and Saibal Roy[1,2]<br>[1]Tyndall National Institute, IRELAND and [2]University College Cork, IRELAND | |

**17:00 Adjourn for the day**

**19:00-21:45** **Conference Banquet**
(included in registration)

# Thursday, 21 November

All indicated times are Central European Time (CET).

**08:50** **Conference Announcements**

**09:00** **Plenary Presentation III**

Chair: Philippe Basset, ESIEE Paris, FRANCE

**ThPA-1** **THERMOELECTRICITY AT A LIQUID METAL INTERFACE**
Christophe Gissinger
Ecole Normale Superieure (ENS), FRANCE

**10:00** **Session Th9A - Energy Harvesting and Power Transfer IV**

Chair: Philippe Basset, ESIEE Paris, FRANCE

10:00 – 10:20

**Th9A-1** **A VERSATILE MEMS ELECTROSTATIC TRANSDUCER STRUCTURE TO ACHIEVE NEAR-ZERO STIFFNESS FOR LOW-FREQUENCY ENERGY HARVESTING**
Shengkai Su[1], Binh Duc Truong[2], Snorre Aunet[1], and Cuong Phu Le[1]
[1]Norwegian University of Science and Technology, NORWAY and [2]University of Michigan, USA

10:20 – 10:40

**Th9A-2** **ENHANCED THERMOPOWER IN THERMOGALVANIC CELLS USING D2O AS A SOLVENT**
Lixian Jiang[1], Shohei Horike[2], Vikas Nandal[1], Kazuhiko Seki[1], and Qingshuo Wei[1]
[1]National Institute of Advanced Industrial Science and Technology, JAPAN and [2]Kobe University, JAPAN

**10:40** **Refreshment Break**

Lobby

| Session Th10A<br>Implantable or<br>Wearable Devices | Session Th10B<br>Actuation and<br>Micro-Propulsion |
|---|---|
| Chair: Shad Roundy,<br>University of Utah, USA | Chair: Dibin Zhu, Shanghai Jiao<br>Tong University, CHINA |
| 11:20 – 11:40 | |
| **Th10A-1**<br>**NOVEL NI-SN ANODE/LIFEOP4 CATHODE NANOSTRUCTURES VIA ENHANCED DEPOSITION FOR ON-CHIP LITHIUM-ION MICRO BATTERIES**<br>Siyao Jiang, Bingmeng Hu,<br>Zerui Xu, and Xiaohong Wang<br>Tsinghua University, CHINA | **Th10B-1**<br>**FORCE SENSING EVALUATION FOR A PIEZOELECTRIC-ACTUATED COMPLIANT ROBOT WITH ONBOARD VISUAL SERVOING**<br>Xu Chen[1], Linchuan Zhao[1,2],<br>Michail E. Kiziroglou[1,3], and<br>Eric M. Yeatman[1]<br>[1]Imperial College London, UK,<br>[2]Shanghai Jiao Tong University,<br>CHINA, and [3]International Hellenic<br>University, GREECE |
| 11:40 – 12:00 | |
| **Th10A-2**<br>**POWER TRANSFER AND 5D POSITION CONTROL OF AN ENDOSCOPIC CAPSULE ROBOT**<br>Anh-Tuan Vo and Nicolas Garraud<br>CEA-Leti, FRANCE | **Th10B-2**<br>**ELECTROMAGNETIC MICROPUMPS BASED ON MULTI-MATERIAL 3D PRINTING**<br>Chen Lin, Michail E. Kiziroglou,<br>and Eric M. Yeatman<br>Imperial College London, UK |

**12:00** **Award Ceremony & Closing Remarks**

Ormen 1&2

**12:30** **Lunch**

Restaurant Lindahl

**13:30** **Conference Adjourns**