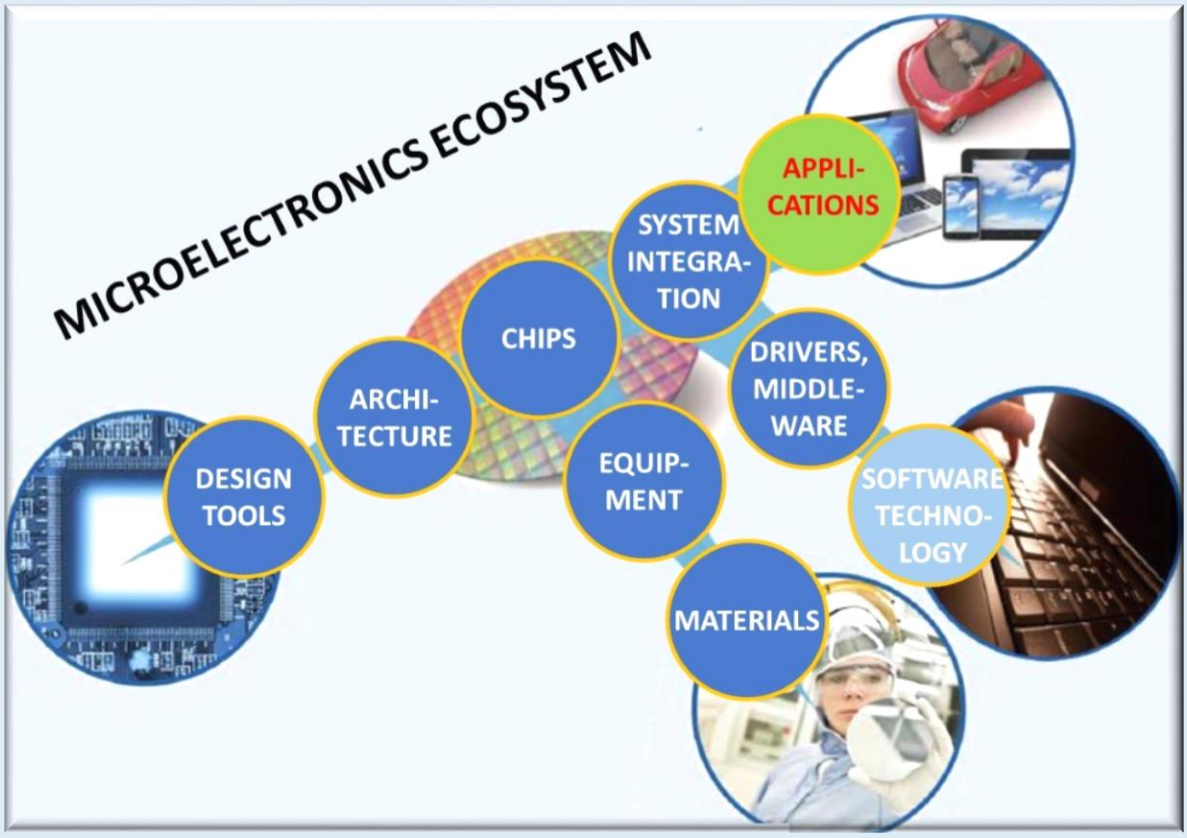
Workshop:

Technological Horizons in Micro and Nanoelectronics. Contributions of Diaspora to the Integration of Romania in International Projects - IPCEI, PNRR, CHIPS ACT -

April 11-13, 2023



Joint event of:

Smart Diaspora. Diaspora in Higher Education, Science, Innovation and Entrepreneurship

April 10-13, 2023, Timișoara, Romania

Workshop: Technological Horizons in Micro and Nanoelectronics

Organized by:

Romanian Academy
Commission for Science and Technology of Micro Systems (STMS)
https://acad.ro/institutia/comisii/comisia_59.html

University Politehnica of Bucharest
http://www.upb.ro

Politehnica University of Timisoara
Faculty of Electronics, Telecommunications and Information Technologies
https://www.upt.ro

Continental Automotive Romania
http://www.continental-automotive.com

Association for Promoting Electronics Technology, APTE
http://www.apte.org.ro

EDITORS: Paul SVASTA, Petru DAN, Cosmin MOISA, Dan LASCU, Andreas WILD, Delia LEPĂDATU
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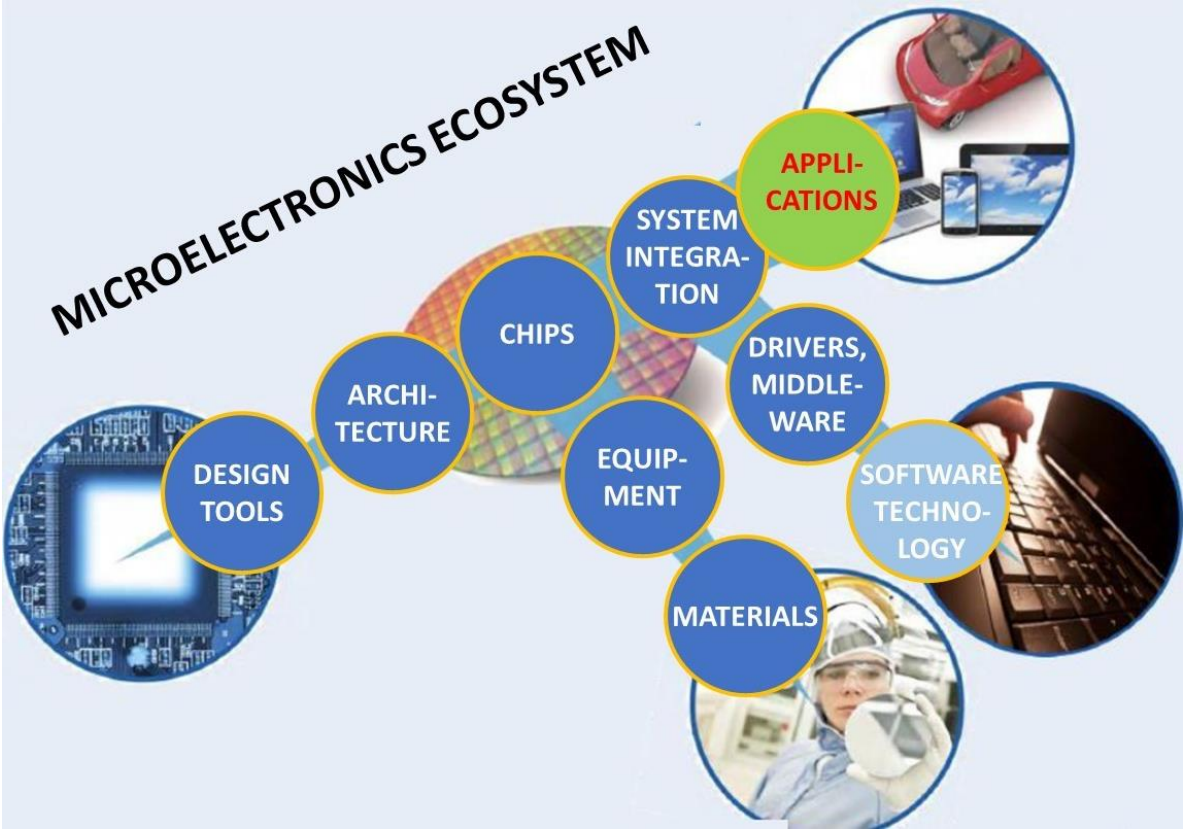

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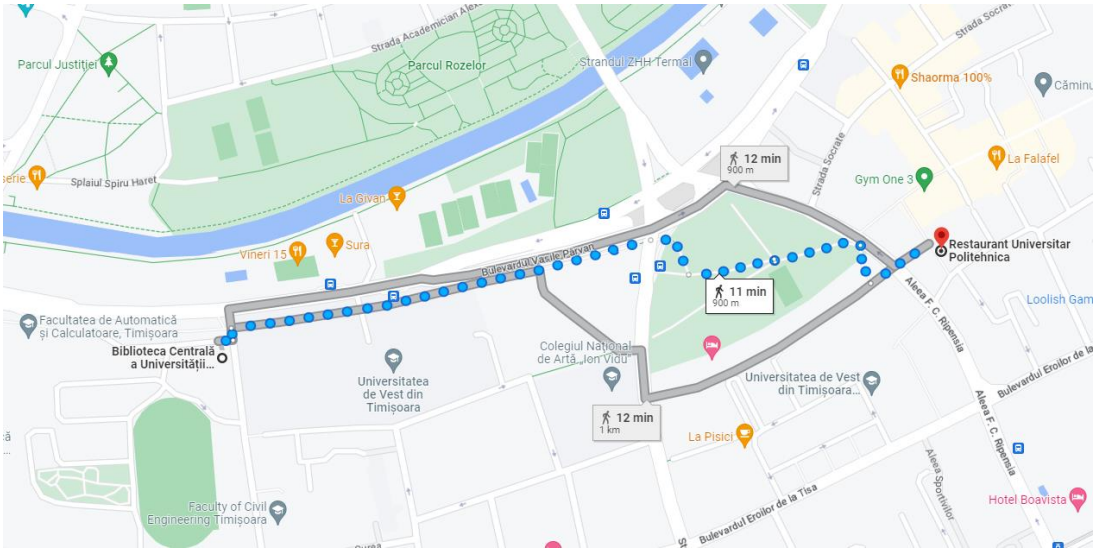
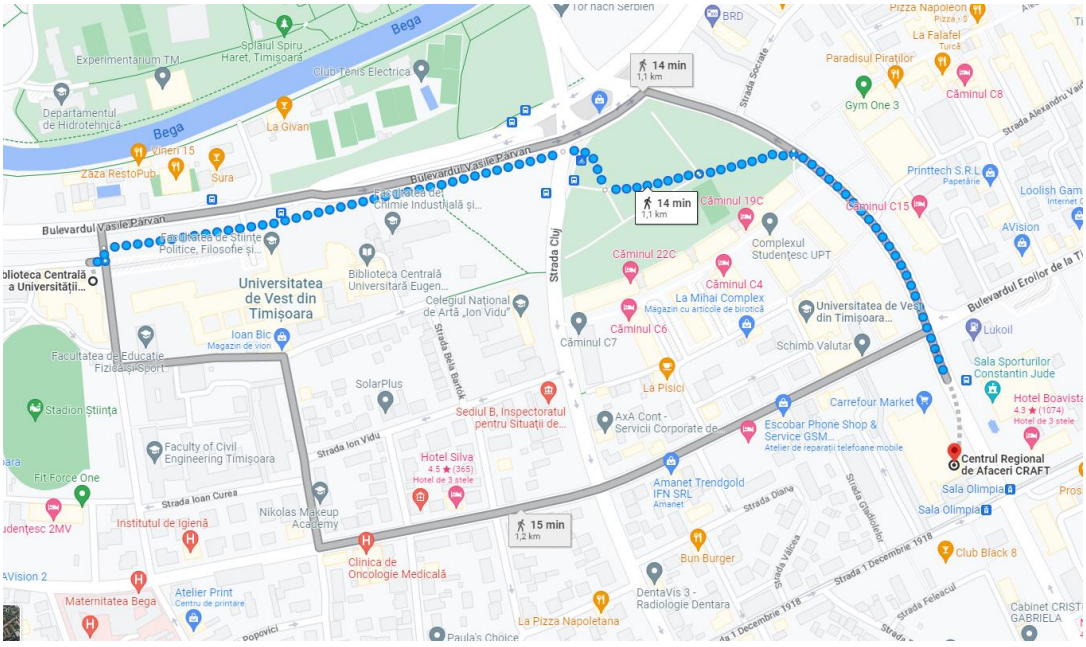
April 10-13, 2023, Timișoara, Romania

Path to Lunch / Dinner:



Path to Gala Dinner from UPT Conference Center:



Workshop: *Technological Horizons in Micro and Nanoelectronics. Contributions of Diaspora to the Integration of Romania in International Projects - IPCEI, PNRR, CHIPS ACT*

Workshop Programme

FOREWORD

After a long interruption, the meeting, under the title Smart Diaspora, starts again in Timisoara, one of the European Capital of Culture in 2023. The workshop on technology horizons in micro- and nanoelectronics, organized under the aegis of the specialized commission in the Romanian Academy, intends to highlight an area of maximum importance in the current global context, in which crises are accumulating and security risks are increasing.

The European Union recognized that the sustainability of the digital transformation critically depends on mastering the microelectronics value chain, the green transition relies on the capabilities provided by this and modern defense technology is unconceivable without these means. The Member States are called to action. Romania can bring into play a critical resource: a tradition of achievement and innovation in the field that needs to be resuscitated, and high-quality human resources, both in the country and in the diaspora, also illustrated by the many representative specialists participating in this event.

The workshop and the interactions that will follow have the purpose to identify strength and plans of action in coordination with the European initiatives, and to provide compelling reasons to the Public Authorities to enhance commitment and investments in this strategic field.

We would like to express our appreciation to all those who contributed and helped organize this important event.

The Organisers,

Acad. George Stefan, Prof. Dan Lascu, Dr. Petru Dan, Dr. Andreas Wild,
Prof. Paul Svasta

Smart Diaspora 2023. *Diaspora in Higher Education, Science, Innovation and Entrepreneurship*

Workshop: *Technological Horizons in Micro and Nanoelectronics. Contributions of Diaspora to the Integration of Romania in International Projects - IPCEI, PNRR, CHIPS ACT*

April 11, 2023

08:00- 08:20 Registration: UPT Conference Center, Vasile Parvan Boulevard 2B (Auditorium Room)

08:20-08:40➢ Opening, Welcome
Workshop Hosts: Prof. Gheorghe Ștefan, Prof. Paul Svasta, Prof. Dan Lascu

08:40-10:00➢ Session 1
Romanian Participation in the European Programs of Technological Innovation and Financial Support Mechanisms (IPCEI ME/CT, CHIPS ACT, PNRR)
Chair: Dr. Simona Rucăreanu (KDT JU, Bruxelles), Ing. Daniel Bucur (Ministry of Economy, Department of Industrial Policies and Competitivity)
1. *Pan-European collaboration on semiconductor based innovation*
Jo De Boeck, Chief Strategy Officer (CSO) and Executive VicePresident - IMEC
Q&A, discussion round
2. *European initiatives and financial support mechanisms. Chips Act, PNRR și IPCEI*
Daniel Bucur, Ministry of Economy
Q&A, discussion round
3. *KDT JU - Keeping Europe at the Forefront of Technology Development*
Simona Rucăreanu, KDT JU, Bruxelles
Q&A, discussion round
4. *Support Center for European Cooperation in Micro-Nanotechnologies (CESMIN) - Enabler for EU Scientific Cooperation*
Carmen Moldovan, IMT, Romania
Q&A, discussion round

10:00-11:00➢ Session 2
By the Miniaturization Limits. Analysis and Metrology at Nanometric Level.
Chair: Prof. Marius Enăchescu (UPB), Dr. Lorena Anghel (Grenoble Institute of Management and Technology)
1. *Metrology Hub for Leading-Edge Semiconductor Architectures*
Marius Enăchescu, UPB
Q&A, discussion round

2. *Spintronic Based Design to Emulate Brain Computing*
Lorena Anghel, Grenoble Institute of Management and Technology
Q&A, discussion round
3. *Synthesis and Characterization of Semiconductor Nanostructures for Nanoelectronics*
Constantin Moise, UPB
Q&A, discussion round

11:00-11:30 ➢ *Coffee break*

11:30-13:00 Session 3
Wide-bandgap Semiconductors: Devices and Circuits
Chair: Prof. Gheorghe Brezeanu (UPB), Dr. Viorel Banu (CNM-IMB CSIC Barcelona)
1. *Advances in high temperature, complex applications of SiC devices*
Viorel Banu, CNM-IMB CSIC Barcelona
Q&A, discussion round
2. *Integrated technology developed in SiC and other wide-bandgap semiconductors for harsh environment power electronics, sensors and quantum nanophononics*
Mihai Lazăr, University of Technology of Troyes, Troyes, France
Q&A, discussion round
3. *Diodes on SiC with non-uniform Schottky contact - suitable for high temperature sensors*
Gheorghe Brezeanu, UPB; Gheorghe Pristavu, UPB
Q&A, discussion round
4. *Read-out circuits and high temperature characterization of SiC sensors*
Florin Drăghici, UPB; Florin Mitu, UPB
Q&A, discussion round

13:00-15:00 ➢ *Lunch (UPT Universitary Restaurant, Aleea FC Ripensia no. 2)*

15:00-16:30 Session 4
Cyber-physical Systems, MEMS and Other Sensors
Chair: Prof. Adrian Ionescu (EPF Lausanne), Dr. Daniel Lăpădatu (AlfaRom)
1. Computational RFID
Mircea Stan, University of Virginia, USA
Q&A, discussion round
2. Mechanically Amplified High-Stability MEMS Gyroscope
Daniel Lăpădatu, Alfa Rom, Romania
Q&A, discussion round
3. SAW sensors on GaN/SiC and GaN/Sapphire
Alexandru Müller, IMT, Romania
Q&A, discussion round

4. Bio-inspired sensing and computation for a future energy efficient Edge AI

Adrian M. Ionescu, EPFL, Lausanne, Switzerland

Q&A, discussion round

16:30-17:00➢ *Coffee break* 3

17:00-18:30 Session 5

Development of Digital Integrated Technologies through Innovative Intelligent Systems for People and Communities

Chair: Dr. Mircea Modreanu (Tyndall National Institute, Cork, Irlanda); Dr. Carmen Moldovan (IMT)

1. *Artificial Intelligence (AI) and Internet of Things (IoT) technologies for improving healthcare access for disadvantaged communities*

Emanuel Popovici, Electrical and Electronic Engineering, University College Cork

Q&A, discussion round

2. *Smart Systems for Environment Monitoring and Biomedical Applications*

Carmen Moldovan, IMT, Romania

Q&A, discussion round

3. *Nanomaterials Enabling Smart Energy Harvesting for Next-Generation Internet-of-Things*

Mircea Modreanu, Tyndall National Institute, University College Cork, Ireland

Q&A, discussion round

19:00 *Dinner* *(UPT Universitary Restaurant, Aleea FC Ripensia nr 2)*

April 12, 2023

Session 6: UPT Conference Center, Vasile Parvan Boulevard 2B (Auditorium Room)

8:30-9:00 Registration at UPT

9:00-10:45 Session 6: Innovation at the Frontier between Chip and Assembly. Chiplet.

Chair: Paul Svasta (UPB), Cosmin Moisa (Continental Automotive)

1. *The Software-defined Vehicle and Its Effects on Vehicle Architecture*

Christian von Albrichsfeld, Continental Automotive

Q&A, discussion round

2. *Beyond Moore's Law: Leveraging Advanced Packaging Technology*

Cătălin Ciobanu, UTBv

Q&A, discussion round

3. *High-Performance Computing in the Netherlands: Overview and developments*

Valeriu Codreanu, SURF

Q&A, discussion round

11:00-11:30➢ *Coffee break*

Exploratory Workshop: UPT Conference Center, Vasile Parvan Boulevard 2B (Auditorium Room):

11:30-13:45 Special Session organized by Romanian Ministry of Economy
Romania's Vision for and Expectations from the European Chips Act
Chair: Eng. Daniel Bucur (Ministry of Economy), Dr. Andreas Wild (Commission of Microsystems Science and Technology, Romanian Academy)

Exclusive visit for Diaspora, University and RTO representatives:
13:45-14:15 Relocation to Continental Automotive Romania, Siemens Str. 1, Building A Extension
14:15-14:30 Welcome by Continental Management Team, Room A6.153.

14:30-15:00➢ *Socializing Lunch* 30 min

15:00-16:15 Visit at Continental Facilities (Group 1 for R&D / Group 2 for Plant)
Guiding coordinators Focus Factories: Lucian Margineanu, Petru Demian, Liviu Almăjan
16:15-17:30 Visit at Continental Facilities (Group 2 for R&D / Group 1 for Plant)
Guiding coordinators R&D: Ciprian Bleoju, Andrei Son, Cosmin Moisa
17:30 Relocation to UPT

19:00 *Gala Dinner CRAFT - Timisoara Regional Business Center,*
B-dul Eroilor de la Tisa 22

April 13, 2023

09:30 – 11:00 Wrapping-up session UPT Conference Center, Vasile Parvan Boulevard 2B (Auditorium Room)
Chair: Dan Lascu (UPT), Cosmin Moisa (Continental Automotive)

11:00 – 13:00 Overall event conclusions (UVT Aula Magna, Vasile Parvan Boulevard 4)

13:00 Trip to Recas Wineyard

08:40-10:00➢ Session 1

Romanian Participation in the European Programs of Technological Innovation and Financial Support Mechanisms (IPCEI ME/CT, CHIPS ACT, PNRR)

The session consists of several presentations, covering the current and future European Technological Programs, available financial mechanisms as well as the participation of Romania in those programs. The session starts with an online a talk about the Pan-European collaboration on semiconductor-based innovation followed by an overview of the European Chips Act, through which the EU aims to address semiconductor shortages and strengthen Europe's technological leadership. It will also cover Romania's participation in the Important Projects of Common European Interest (IPCEI) II for microelectronics, a program which is currently supported financially through the NRRP.
The next two presentations address, one, the KDT JU program, which funds Research, Development, and Innovation projects in the Electronic Components and Systems sector, by engaging finances from the EU, MS and private sector, under the umbrella of the Horizon Europe program. Romania was present in the JU from its inception and participated in various projects, mainly on the academic side, and finally, a talks about the Support CEnter for European cooperation in MIcro- Nanotechnologies (CESMIN), a project open to all public or private Romanian Organizations (RTOs, Universities, Companies) which is co-financed by the European Regional Development Fund, through the Competitiveness Operational Program 2014-2020.

Chairs: Dr. Simona Rucăreanu (KDT JU, Bruxelles),
Ing. Daniel Bucur (Ministry of Economy, Department of Industrial Policies and Competitivity)

1. Pan-European collaboration on semiconductor based innovation
Jo De Boeck, Chief Strategy Officer (CSO) and Executive VicePresident - IMEC
Q&A, discussion round

2. European initiatives and financial support mechanisms. Chips Act, PNRR și IPCEI
Daniel Bucur, Ministry of Economy
Q&A, discussion round

3. KDT JU - Keeping Europe at the Forefront of Technology Development
Simona Rucăreanu, KDT JU, Bruxelles
Q&A, discussion round

4. Support Center for European Cooperation in Micro-Nanotechnologies (CESMIN) - Enabler for EU Scientific Cooperation
Carmen Moldovan, IMT, Romania
Q&A, discussion round

Name: Bucur Marian Daniel
Position: Head of Competitivity Unit
Affiliation: Ministry of Economy

Short CV: Graduated in 1993 the Faculty of Electrical Engineering UPB. Worked for RENEL, as an electrical engineer and then as an energy consultant in Brussels for EURELECTRIC. Moved to the industry where attained the position of Product Marketing Manager in GE Security and then Engineering Manager in TYCO Thermal Controls. Returned in Romania in 2015 and worked as senior adviser in the Ministry of Finance. Since 2022 joined the Ministry of Economy as Head of Competitivity Unit.

TITLE: European initiatives and financial support mechanisms

Abstract: Recent global semiconductor shortages forced factory closures in a range of sectors, from cars to healthcare devices. This made more evident the extreme global dependency of the semiconductor value chain on a very limited number of actors in a complex geopolitical context. With the European Chips Act, the EU aims to address semiconductor shortages and strengthen Europe's technological leadership. It aims to mobilize more than € 43 billion of public and private investments and set measures to prepare, anticipate and swiftly respond to any future supply chain disruptions.

Romania is active, both at European and national level to help strengthen the semiconductor ecosystem, to achieve the goals to increase the EU's security of supply of semiconductors and develop new markets for cutting-edge European technologies. It has representation in all the technical working groups set by the European Commission and initiated the dialogue with the industry in order to attract investments and encourage technological transfers.

Romania was one of the 18 Member States signatories of the Joint Declaration on the European Initiative for Processors and Semiconductors, December 2020. The initiative resulted in the "Important Project of Common European Interest (IPCEI)" II for microelectronics, which is also financially supported through the National Recovery and Resilience Plan.

Name: Simona Rucareanu
Position: Programme Officer
Affiliation: KDT Joint Undertaking

Dr. Simona Rucareanu is a Programme Officer at KDT JU (Key Digital Technologies Joint Undertaking) before which she held the same position at ECSEL JU and ENIAC JU. Prior to joining ENIAC JU in 2011, she held various positions in industry and academia (Bayer AG-Germany, TNO-Netherlands, Biotehnos SA-Romania). She graduated from University of Bucharest, Romania, has a PhD from University of Fribourg, Switzerland and did a postdoc at University McGill, Montreal, Canada.

TITLE: KDT JU - keeping Europe at the forefront of technology development

Abstract: KDT JU funds Research, Development, and Innovation projects in Electronic Components and Systems sector by engaging finances from the EU, countries and participants under the umbrella of the Horizon Europe programme. It builds on the success of its predecessor – ECSEL JU (Electronic Components and Systems for European Leadership), which was part of the Horizon 2020 and which in turn was set up on the solid and robust basis of ENIAC JU and ARTEMIS JU (FP7). The JU-concept started in 2008 a first of a kind of tripartite mechanism in the universe of the European institutions. In 2023, 3 EU frame programmes and 3 generations of JUs later it proved its added value and strategic importance in supporting the electronics industry by being chosen to implement the largest part of the CHIPS ACT. These 3 generations of JUs significantly contributed to strengthen the electronics industry in EU by successfully aligning the national strategies with the Participating States and building a dynamic ecosystem involving all contributors: large enterprises, SMEs (small and medium-sized enterprises), academia and research centers. They managed to reduce the gap from lab to fab and enhance the capability to convert excellent research into industrial transfer. Since the beginning (ENIAC JU time) Romania was always present especially on the academic side. Romanian participation in various projects has been welcomed and well appreciated by the community involved in the respective projects.

Name: Carmen Moldovan
Position: Director of the Research Center for Integration of Technologies (CINTECH**)**
Affiliation: National Institute for R&D in Microtechnologies **(IMT-Bucharest)**

Dr. Carmen Moldovan graduated on Electronics and Telecommunications at Politehnica Bucharest and holds a PhD in Microelectronics. She joint IMT Bucharest in 1996 working on development of chemosensors and biosensors, implantable micro-nanoelectrodes and neuronal microprobes, nanowire transistors, M(N)EMS, BioMEMS, microfluidics signal processing and micro-nanosystems integration, for different applications. Carmen is/ was leading/ participating more than 20 EU projects and more of 35 National projects. She is also Director of CESMIN project.

CESMIN
www.imt.ro/CESMIN

TITLE: Support CEnter for European Cooperation in MIcro- Nanotechnologies (CESMIN) - Enabler for EU scientific Cooperation

ABSTRACT CESMIN objective is to offer consultancy services, with the help of experts team having extended experience in EU projects, with the goal to facilitate the access to European funds. The support offered by CESMIN consists in: identification of European calls in micro nanotechnology area; assistance in proposal elaboration; partners identification; identification of appropriate calls, financing sources; technical feasibility evaluation; IPR, impact; dissemination of Romanian organizations offers for various competitions; Organizing workshops for the preparation of RDI project proposals to be submitted to competitions funded by Horizon Europe and other European programs.
The project is open **to all public or private Romanian Organisations (RTOs, Universities, Companies)** interested in developing applications based on Micro-Nanoelectronics, Photonics, Nanotechnology.

Results: Building the micro - nanotechnologies community; Creating a Network of EU Organisations; Database of potential partners; Sharing information and knowledge; Successful applications in EU programmes; Connecting people; Large Dissemination; Large impact (technological, scientific, economic, social).

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme 2014-2020.
BENEFICIARY: National Institute for Research and Development in Microtechnologies - IMT BUCHAREST *www.imt.ro*
Director: Dr Carmen Moldovan

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10:00-11:00➢ Session 2

By the Miniaturization Limits. Analysis and Metrology at Nanometric Level.

Today's topics in micro- and nano-electronics are very diverse and many times much focused on certain aspects of what a device should offer. Over the past decades computing power was exponentially enhanced by transistor-based chips. There was done a continuous progress in traditional transistor scaling. Despite of this, the semiconductor industry has reached an inflection point. A new design and manufacturing paradigms came out as the demand for faster, smaller, smarter, and more energy-efficient chips is continuously growing. So, we need to prepare for the future. And for this we may need to explore serious questions, such as:

- Are carbon nanotubes, graphene, and other 2D materials the new contenders for the post-silicon age?
- Will future of electronics be powered by SiC and GaN?
- The path to high-speed, energy-efficient data processing could be solved by photonics?
- Is heterogeneous integration opening new possibilities in IC packaging?
- Brain-like computers will be based on neuromorphic technologies?
- Why is quantum computing important and how does it work?
- Is sustainable electronics attainable?

This session may shine some light in some of the aspects of the questions we are facing in today's micro- and nano-electronics topics.

Chairs: Prof. Marius Enăchescu (UPB),
Dr. Lorena Anghel (Grenoble Institute of Management and Technology)
Q&A, discussion round

1. Metrology Hub for Leading-Edge Semiconductor Architectures
Marius Enăchescu, UPB
Q&A, discussion round

2. Spintronic Based Design to Emulate Brain Computing
Lorena Anghel, Grenoble Institute of Management and Technology
Q&A, discussion round

3. Synthesis and Characterization of Semiconductor Nanostructures for Nanoelectronics
Constantin Moise, UPB
Q&A, discussion round

Name: Prof. Dr.rer.nat. Marius ENĂCHESCU
Position: Full Professor (UPB), General Manager (CSSNT)
Affiliation: Center for Surface Science and Nanotechnology, University POLITEHNICA of Bucharest, Romania

Prof. Dr.rer.nat. Marius Enăchescu, some key professional aspects**: (1)** one of the world pioneers in designing and building STM-AFM; **(2)** research in world leading labs, Lawrence Berkley Lab.; **(3)** CEO&CTO at Marena Systems Co., Silicon Valley, USA; **(4)** Prof. at UPB, Vice-Rector and Dir. of Council for Doc. Studies at the Univ. of Pitesti; **(5)** author/co-author of 12 int. patents: USA-5, Taiwan-2, Europe-4, China-1; 9 books/chapters; >100 articles in ISI journals; ~250 conferences/congresses; **(6)** led >38 int. projects in USA/EU; **(7)** founder and Head of the CSSNT-UPB.

TITLE: METROLOGY HUB FOR LEADING-EDGE SEMICONDUCTOR ARHITECTURES

Abstract: The importance of semiconductor-based electronic devices in human lives has grown significantly in recent years. Researchers and engineers are devoting continuous efforts to develop key technologies/capabilities that enable the realization of new generations of integrated circuits (ICs) with increasingly smaller electronic nodes as evidenced by Moore's Law and by More than Moore. Current developments are targeting technologies that allow the realization of 3nm, 2nm and even 1.4nm technological nodes, within ECSEL-JU/KDT-JU PiN3S, IT2 and 14ACMOS/14AMI projects, respectively. One of the crucial pillars that allow such technological advances is the metrology. It is mandatory to optimize/develop the metrological tools and/or the experimental approaches/methodologies so as to enable them to meet the challenges imposed by the new sizes of the electronic nodes. With each reduction in the technology node, the use of complex 3D structures/arhitectures fabricated using new materials and processes is also accelerating in the coming years. CSSNT-UPB, throughtout the time has participated as metrology provider in multiple EU projects dealing with developments of future IC generations. Thus, CSSNT-UPB is continuously working on furthering its metrological capabilities to offer state-of-the-art metrological solutions/services in support of industrial developments, carried out within the most challenging nanoelectronics projects, of which the following are on-going R3POWER-UP, REACTION, PiN3S, IT2, BEYOND5, 14ACMOS, HICONNECTS, 14AMI and R-PODID.

Name: LORENA ANGHEL
Position: Full Professor
Affiliation: Grenoble Institute of Management and Technology

Lorena ANGHEL (MS 97, PHD 2000) is Distinguished Full Professor at Grenoble INP, France for Micro and Nano-electronic System Design and head of AI group in SPINTEC Laboratory. Her research interests include hardware design and testing of convolutional and event based neural networks, with special emphasis on fault tolerance, reliability and verification. From 2016 to 2020, she was Vice President of Grenoble INP, in charge of industrial relationships, where she is currently holding a Scientific Director position.

She has published more than 150 books, journals, international conference and symposia and has supervised 26 Ph.D. students. She was recipient of several best and outstanding paper awards. She had fulfilled positions, such as the General Chair and the Program Chair for many prestigious IEEE/ACM conferences such as VTS, ETS, NANOARCH, DATE, etc. She had served as Vice Chair of the steering committee of IEEE/ACM DATE conference. She has been involved in numerous European research projects (MEDEA+ PARACHUTE, CATRENE 3DIM3, PENTA HADES, MSC, COST), national research projects (ANR), and industrial research projects with major semiconductor companies.

TITLE: SPINTRONIC BASED DESIGN TO EMULATE BRAIN COMPUTING

Abstract: Shifting AI inference and training processes from current cloud-based infrastructures towards embedded architectures poses severe challenges, notably in terms of energy efficiency, smaller area needs, reconfigurability, high prediction accuracy and output explainability. Conventional neural network hardware implementations are not able to effectively estimate the uncertainty of their predictions, leading to overconfident results. Estimating uncertainty is crucial for safety-critical applications such as those deployed in autonomous vehicle driving or in medical diagnosis and treatment applications. Computing-in-memory (CiM) architectures with emerging non-volatile memories (NVMs) are promising candidates for accelerating classical NNs. Spintronics, which are distinguished by their low latency and high endurance, aligns very well with these requirements. This talk pictures hardware design architectures that efficiently solve the problems of image classification in a probabilistic, brain-like computing style with very low memory overhead and energy consumption.

Name: Dr. Phys. Călin Constantin MOISE
Position: Researcher
Affiliation: Center for Surface Science and Nanotechnology, University POLITEHNICA of Bucharest, Romania

Dr. Călin-Constantin Moise is a researcher at the Center for Surface Science and Nanotechnology, UPB. His main activities relate to the synthesis and characterization of various nanomaterials and thin films, including carbon-based. Between 1994 and 1996 he received a Japanese government fellowship (Monbusho) being visiting researcher at the Catalysis Research Center - Hokkaido University. He has published more than 30 papers that generated over 250 citations and has *h*-factor 9.

TITLE: SYNTHESIS AND CHARACTERIZATION OF SEMICONDUCTOR NANOSTRUCTURES FOR NANOELECTRONICS

Abstract: As the semiconductor industry advances, it needs to build smaller and smaller devices. For this purpose, nanomaterials synthesis and characterization are the mandatory starting point in building any nano-electronic structures or devices. Five different nanostructured materials CuO, InP, GaN and columns of Cu and CuO will be introduced. They differ one from the other by structure, properties and by the synthesis method. CuO nanowires (NWs) were obtained as a result of the fast thermal oxidation of Cu foil. The Indium Phosphide and Gallium Nitride nanotemplates were obtained by applying electro-chemical etching processes. On the other hand, Cu and CuO columns are prepared by sputtering a Cu target in Ar and Air, respectively. Complex characterizations results will be presented. The use of each nanostructure in further devices or applications will be suggested.

11:30-13:00 ➢ Session 3

Wide-bandgap Semiconductors: Devices and Circuits

The considerable industrial interest in wide band semiconductors (WBS), following their promising applications in power electronics, hostile-environment electronics and sensors, has led to substantial international research effort over the last 20 years.
Low intrinsic carrier concentration, high breakdown field, high-saturated electron velocity and high thermal conductivity enable devices on WBS to operate at high temperatures, under extreme conditions. SiC is ideal for kV-rated power switching devices, substantially improving system efficiency in electrical vehicles and their charging. For operation below 300 V, the cost-to-performance benefit of SiC is rather flat and GaN is preferred.
Centro Nacional de Microelectronica (CNM) of Barcelona, *University of Technology of Troyes(UTT) and University Politehnica of Bucharest (UPB)* have well-equipped laboratories for technology and electrical characterization of WBS devices and circuits. Dedicated Romanian or Smart Diaspora researchers, who participate at S3 of the **Smart Daspora** workshop, work within these laboratories.
A notable CNM paper highlights important results on SiC high voltage diodes, MOSFETs, JFETs, BJT and temperature voltage references, able to work up to 320 °C.
Another S3 communication (from UTT) evinces new technological developments for SiC monolithic integration, which reduce of processing time and thus costs, demonstrated for quantum nanophotonic devices.
Two UPB papers are focused on wide-range temperature sensors based on SiC devices. The impact of Schottky contact inhomogeneity on sensing performances is thoroughly analyzed. An original model for Schottky contact non-uniformities is considered for performance assessment. Potential architectures of associated readout circuits and the high temperature SiC device testing facility are also presented.

Chairs: Prof. Gheorghe Brezeanu (UPB),
Dr. Viorel Banu (CNM-IMB CSIC Barcelona)

1. Advances in high temperature, complex applications of SiC devices
Viorel Banu, CNM-IMB CSIC Barcelona

2. Integrated technology developed in SiC and other wide-bandgap semiconductors for harsh environment power electronics, sensors and quantum nanophononics
Mihai Lazăr, University of Technology of Troyes, Troyes, France

3. Diodes on SiC with non-uniform Schottky contact - suitable for high temperature sensors
Gheorghe Brezeanu, UPB; Gheorghe Pristavu, UPB

4. Read-out circuits and high temperature characterization of SiC sensors
Florin Drăghici, UPB; Florin Mitu, UPB

Name: Viorel Banu
Position: Design test and of SiC devices
Affiliation: D+T Microelectronica A.I.E. - CSIC, Barcelona

Viorel Banu graduated IPB in 1978. He start working in production and development of high power diodes and thyristors at IPRS Băneasa. In 1999 he became head of the High Power Diodes and Thyristors Department up to 2006. He also worked as design engineer for Analog Integrated circuits at O2Micro-Romania (2001-2007). Since 2007 he joined the National Center for Microelectronics, Barcelona, where he is in charge for the technology of wide bandgap semiconductors for power devices at D+T Microelectronica A.I.E.

TITLE: Advances in high temperature, complex applications of SiC devices

Abstract: The progresses in manufacturing high quality wide bandgap materials from the last decade enabled the presence on the market of a wide variety of SiC devices that start to replace the former silicon power devices in many new power management projects. However some issues remain to be solved in the future for this new generation of power devices built on wide band-gap semiconductors. The presentation shows the response to these challenges of the research group from the Laboratory Power Devices and Systems from IMB-CNM CSIC, Barcelona, Catalunya-Spain. There are briefly presented the development results for high voltage diodes, MOSFETs, JFETs, BJT, and basic monolithic digital gates Circuits based on MESFETs. Experimental results of an original and patented high temperature voltage reference based on SiC able to work up to 320 °C are presented as well. The last but not the least, is presented the successfully participation to the space missions BepiColombo to Mercury Planet, and Solar Orbiter, as supplier for the European Space Agency (ESA) of high temperature diodes used in solar panels. Images of the last flyby around Mercury are shown to prove proper operation of our SiC Shottky diodes, used for these space missions at extreme temperatures, -170 °C to +270 °C.

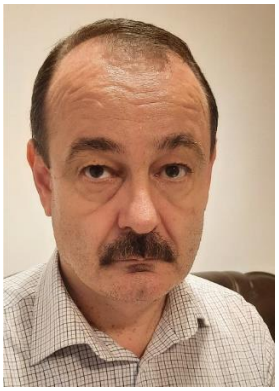
Name: Gheorghe Brezeanu
Position: Professor
Affiliation: University "Politehnica" of Bucharest (UPB)

Gheorghe Brezeanu became a Full Professor at the Electronic, Telecommunications and Information Technology faculty from UPB in 1992. He was Scientific Chairman of the Faculty between 1996 and 2012 and until 2020 he was the Ph.D. School director. His main area of research includes: physics, modeling and fabrication of power and sensor devices on Si and SiC, design and electrical characterization of low-power analog ICs. He leads the Electronic Devices and Circuits – Advanced Studies Laboratory, focused on design, modeling and high-temperature testing of SiC devices and circuits. He authored 20 books and over 220 WoS indexed articles.

TITLE: DIODES ON SIC WITH NON-UNIFORM SCHOTTKY CONTACT - SUITABLE FOR HIGH TEMPERATURE SENSING?

Gheorghe Brezeanu, Gheorghe Pristavu

Abstract. An analysis of high temperature sensors based on Silicon Carbide (SiC) Schottky diodes, with Ni and Ti contacts, is presented. Initially, material properties of silicon carbide semiconductor are discussed in conjunction with its primary applications in power electronics and sensors. SiC devices' capability to operate at high temperature, in hostile environments, is evinced. Among the commercially available SiC-based electron devices, the Schottky diode has reached the highest level of technological maturity. The greatest challenge in determining diode performances as sensor was posed by the spurious, but universal, occurrence of contact Schottky inhomogeneity. According to the parallel conduction concept, an inhomogeneous Schottky contact is made up of multiple regions, each with their associated area and barrier height. Sample diodes, with both Ni and Ti Schottky contacts on 4H-SiC, are parameterized using our recently developed model, focusing on evincing practical device performances. Electrical behavior structures can thus be accurately modeled over wide temperature ranges, employing only a minimal set of parameters. Values close to unity for the coefficient of determination (R^2) between model and measurements (R^2> 0.99), enable the assessment of SiC device performances as temperature sensors up to 700K. It is proven that even SiC Schottky diodes with non-uniform contacts may operate predictably at such high temperatures, with suitable sensitivity and linearity.



Name: Florin Drăghici
Position: Professor
Affiliation: University Politehnica of Bucharest (UPB)

Florin Drăghici received his PhD degree in 2004 and become full professor in 2022 at UPB. He started and coordinates a project of analog circuits with practical completion. It is a discipline followed by all students of the faculty.
His research activities is focused on the high temperature testing systems and readout circuits for silicon carbide devices.
Also he has contributions in the field of electronic devices and circuits, analog or mixed VLSI integrated circuits design, sensors and interfaces for sensors.

READOUT CIRCUITS AND HIGH TEMPERATURE CHARACTERIZATION OF SiC SENSORS

Florin Drăghici, Florin Mitu

Abstract: Silicon carbide (SiC) is a semiconductor material with wide bandgap that, along with high chemical stability, gives a electronic device made on this material the ability to work in hostile environments and high temperature. Characterization of high temperature behavior is a necessity for SiC devices and the testing systems developed to silicon devices are not suitable.
Sensors represent a class of electronic devices that can exploit the SiC stability and high temperature operation. Integrating of the readout circuit together with the sensor to benefit from noise reduction and minimal costs is not yet industrially feasible, although experiments from various research projects have shown the possibility of making integrated circuits in SiC.
For this reason, in the case of sensors developed on SiC, the processing circuit will be one based on silicon devices that will be placed at an enough distance from sensor to work in safe condition in the case of using the SiC sensor in high temperature and harsh environment.
In the presentation are shown solutions to high temperature testing for sensors made on SiC and readout circuits for processing the signals provided by them.

15:00-16:30 ➢ Session 4

Cyber-physical Systems, MEMS and Other Sensors

In the first talk, will address the so called computational Radio Frequency Identification (RFID) as an emerging technology that involves embedding computational capabilities into RFID tags, enabling them to perform advanced data processing. When combined with Cyber-Physical Systems (CPS), the potential applications of Computational RFID cover Industry 4.0, to healthcare and smart cities. In the second talk an innovative architecture and fabrication method for a family of mechanically amplified high-stability MEMS gyroscopes, for tactical and navigation grade applications will be presented. The device architecture exploits a dual or a quad mass tuning fork vibratory gyroscope with decoupled drive and sense modes, in combination with in-plane linear movement for both the drive and sense modes. The third talk of the session encompasses SAW resonators, manufactured on classical bulk semiconductor materials like quartz, lithium niobate, lithium tantalate, etc. Such devices are used in a wide area of applications, such as filters for mobile communications, sensors for wireless data transmissions and battery-less operation for harsh environments. In the last talk of the session, the challenge of new classes of scalable neuromorphic hardware enabling energy-efficient chips designed for Edge AI and autonomous operation with embedded spiking sensors, will be reported. The electronic functionalities and the structure of such new kind of neuromorphic hardware are greatly inspired by biological neural systems and combines many material and device innovations such as: memristive phase change materials and devices, ferroelectricity in doped high-k dielectrics and multi-gated 2D semiconducting devices, capable to emulate both artificial synapses and neurons.

Chairs: Prof. Adrian Ionescu (EPF Lausanne), Dr. Daniel Lăpădatu (AlfaRom)

1. Computational RFID
Mircea Stan, University of Virginia, USA
Q&A, discussion round

2. Mechanically Amplified High-Stability MEMS Gyroscope
Daniel Lăpădatu, Alfa Rom, Romania
Q&A, discussion round

3. SAW sensors on GaN/SiC and GaN/Sapphire
Alexandru Müller, IMT, Romania
Q&A, discussion round

4. Bio-inspired sensing and computation for a future energy efficient Edge AI
Adrian M. Ionescu, EPFL, Lausanne, Switzerland
Q&A, discussion round

Name: Mircea Stan
Position: Professor, Electrical and Computer Engineering
Affiliation: Virginia Microelectronics Consortium (VMEC), University of Virginia, USA

Mircea R. Stan received the Ph.D. (1996) and the M.S. (1994) degrees from UMass Amherst and the Diploma (1984) from the Polytechnic Institute in Bucharest, Romania. Since 1996 he has been with the ECE Department at UVa, where he is now the Virginia Microelectronics Consortium (VMEC) professor. Prof. Stan is teaching and doing research in the areas of high-performance low-power VLSI, temperature-aware circuits and architecture, embedded systems, spintronics, and nanoelectronics. He leads the High-Performance Low-Power (HPLP) lab, is an associate director of the Center for Automata Processing (CAP), and is on the leadership council for the Link Lab. He was a visiting faculty at UC Berkeley in 2004-2005, at IBM in 2000, and at Intel in 2002 and 1999. He received the 2018 Influential ISCA Paper Award, the NSF CAREER award in 1997 and was a co-author on many best paper awards. He is Associate Editor-in-Chief for the IEEE TVLSI, Senior Editor for the IEEE TNano, AE for IEEE Design & Test, and was an AE for the IEEE TNano, IEEE TCAS I and for the IEEE TVLSI. He was Guest Editor for the IEEE Computer special issue on Power-Aware Computing in 2003 and a Distinguished Lecturer for the IEEE Circuits and Systems (CAS) Society and for the Solid-State Circuits Society. Prof. Stan is a fellow of the IEEE, a member of ACM, and of Eta Kappa Nu, Phi Kappa Phi and Sigma Xi.

TITLE: Computational RFID

Abstract: Computational Radio Frequency Identification (RFID) is an emerging technology that involves embedding computational capabilities into RFID tags, enabling them to perform advanced data processing and analysis tasks. When combined with Cyber-Physical Systems (CPS), the potential applications of Computational RFID are vast, ranging from Industry 4.0, to healthcare and smart cities. This presentation will explore some of the benefits and challenges of integrating Computational RFID into CPS systems. We will discuss how Computational RFID can enable real-time data analysis, enhance system performance and efficiency, and enable new applications such as predictive maintenance and smart buildings. Finally, we will highlight some ongoing research efforts and future directions in the field of Computational RFID for CPS applications. It is hoped that this presentation will provide an overview of the potential benefits and challenges of integrating Computational RFID into CPS systems and stimulate further research in this rapidly evolving field.

Name: Daniel Lăpădatu
Position: Technical Director
Affiliation: Alfa Rom Consulting

Mr Lăpădatu has a Ph.D. in applied sciences from KU Leuven, Belgium, specializing in microelectronics, microtechnology and solid-state physics. He has more than 25 years' experience in design, development, manufacturing, testing and calibration of MEMS devices and inertial navigation systems. He has led research and development projects at Sensonor, Infineon Technologies, poLight and Alfa Rom Consulting.

TITLE: Mechanically Amplified High-Stability MEMS Gyroscope

Abstract: The presentation describes a novel architecture and fabrication method for a family of mechanically amplified high-stability MEMS gyroscopes, addressing several limitations of conventional similar devices for tactical and navigation grade applications. The device represents a dual or a quad mass tuning fork vibratory gyroscope with decoupled drive and sense modes, in combination with in-plane linear movement for both the drive and sense modes. The device uses mechanical amplifiers to enhance the drive mode or the Coriolis-induced motions of the proof masses or both. Furthermore, the mechanical amplifiers are configured to provide a linear, amplified and balanced anti-phase drive and sense mode motions, suppress the parasitic in-phase movement of the masses, amplify the mechanical Coriolis movement, reduce the sense actuation force needed to counter-balance the Coriolis force and minimize the energy dissipation to the substrate, resulting in a device with increased quality factors, high rejection of common-mode signals originating from the environment, improved stability and angle random walk. The device also contains blocks for compensating the quadrature errors and adjusting the sense mode frequency. The devices are fabricated in a micromachined cavity-SOI wafer, which is subsequently bonded in high vacuum to a capping wafer comprising the electrical routing of signals and the device pads.

Name: Alexandru Müller

Position: Laboratory Head
Affiliation: IMT Bucharest

ALEXANDRU MÜLLER received the Ph.D. degree in semiconductor physics from the University of Bucharest, and the Habilitation degree in electronic engineering, information technologies and telecommunications from Politehnica University of Bucharest. He is the Head of the Microwave Laboratory, IMT-Bucharest. His research activity is focused on SAW devices developed on III Nitrides, analysis of SAW propagation modes in GaN/Si layers, temperature and pressure sensors based on GaN/Si SAW devices, coupling of SAW waves with spin waves, cryogenic temperature measurements, in high magnetic field, of single electron transistors. He is the author of more than 150 papers in high ranked journals and conferences proceedings. In 2003, he was invited ‘‘Directeur de recherche’’ at LAAS CNRS Toulouse, France. He was/is involved in many European projects.

TITLE: III-Nitride based SAW resonators and sensors and emerging applications developed in collaborative European projects

Abstract: SAW resonators, manufactured on classical bulk semiconductor materials like quartz, lithium niobate, lithium tantalate, etc., have intensively been used in a wide area of applications, like filters for mobile communications, sensors for wireless data transmissions and battery-less operation for harsh environmental operation. SAW resonators have been also used also in more exotic applications like coupling of surface acoustic waves with spin waves. Lithium niobate, quartz and lithium tantalite have excellent piezoelectric properties but their surface quality is practical incompatible with advanced nanolithographic techniques This makes impossible their use at frequencies above 2 GHz. Increasing of the resonance frequencies of SAW devices is an important tool for future communication, sensor and spintronic connected applications. This work will present progress done by IMT in the development of GHz operating SAW devices using the Rayleigh, Sezawa and Lamb propagation modes. The devices were manufactured thin III-Nitride piezoelectric semiconductor layers, deposited on Si and also other bulk semiconductors. Using advanced nanolithographic and micromachining techniques. SAW resonators on GaN/Si, AlN/Si GaN/SiC and also ScAlN/Si have been successfully developed and sensors as well as other devices based on these resonators were developed and used in advanced demonstrators fabricated in collaborative European projects.

Name: Adrian M. Ionescu
Position: Nanolab Head
Affiliation: EPFL, Lausanne, Switzerland

Adrian M. Ionescu is a Full Professor of Nanoelectronics at Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland. Prof. Ionescu has published more than 600 articles in international journals and conference proceedings. He is the recipient of IBM Faculty Award 2013 for contributions to the Engineering and the recipient of André Blondel Medal 2009 of the Society of Electrical and Electronics Engineering, Paris, France. He and his group received the IEEE George Smith Award in 2017. He is an IEEE Fellow and in 2015 he was elected as a member of the Swiss Academy of Sciences (SATW). In the same year he received the Outstanding Achievement Award of SATW for the successful coordination and delivery of the first national Swiss Technology Outlook to the Swiss government. In 2016 he received an Advanced ERC (European Research Council) Grant for individual senior scientists in Europe to develop a program aiming at energy efficient computation and sensing for Internet-of-Things. Currently, he leads the FET Proactive DIGIPREDICT Consortium, developing Digital Twins for P3 Healthcare at the Edge.

TITLE: Bio-inspired sensing and computation for a future energy efficient Edge AI

Abstract: The predicted deployment in tens of billions of Edge Artificial Intelligent (Edge AI) Internet-of-Things nodes based uniquely on traditional chip technologies is facing multiple sustainability issues from the point of view of energy efficiency and of electronic waste. This talk will address the challenge of new classes of scalable neuromorphic hardware enabling energy-efficient chips designed for Edge AI and autonomous operation with embedded spiking sensors. The electronic functionalities and the structure of this neuromorphic hardware are greatly inspired by biological neural systems and is based on combining a few material and device innovations such as: memristive phase change materials and devices, ferroelectricity in doped high-k dielectrics and multi-gated 2D semiconducting devices, capable to emulate both artificial synapses and neurons. We envision a technological effort from material to system level that will permit the integration of spiking neuromorphic hardware in the back-end-of-line (BEOL) of advanced silicon CMOS platforms, providing not only the co-integration with digital technologies but also the extension of silicon chips exploiting the 3rd dimension, preserving reduced footprints and integrating sensory functionality.

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17:00-18:30 ➢ Session 5

Development of Digital Integrated Technologies through Innovative Intelligent Systems for People and Communities

The session consists in three presentations, covering the current and future trends of key digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), micro and nanoelectronics and smart systems with a particular focus on their impact on improving citizen health and on smart systems for environment. The first one gives an overview of the use Artificial Intelligence (AI) and Internet of Things (IoT) technologies for improving healthcare access for disadvantaged communities. This presentation addresses advances in the Internet of Things and AI technologies to detect seizures and congenital heart disease in neonates. The second presentation addresses the emerging concepts of Smart Systems for environment monitoring and biomedical applications that are developed in National Institute for R&D in Microtechnologies-IMT-Bucharest. The third presentation talks about the emerging technologies for the Smart Energy Harvesting for Next-Generation Internet-of-Things that are currently developed within the framework of a European Innovation Council FETProactive project NANO-EH and of the HORIZON-WIDERA-2021-ACCESS-03-01 NET4Air. In this talk a technological platform exploiting the abundant clean source of always-on RF energy over an extended spectrum range (2G/3G/Wi-Fi/5G) while integrating on-chip energy storage functionalities will be discussed.

Acknowledgements: The support from European Union's HORIZON-WIDERA-2021-ACCESS-03-01 program under grant agreement No 101079455 for the organisation of this event is acknowledged by the session organisers.

Chairs: Dr. Mircea Modreanu (Tyndall National Institute, Cork, Irland);
Dr. Carmen Moldovan (IMT)

1. Artificial Intelligence (AI) and Internet of Things (IoT) technologies for improving healthcare access for disadvantaged communities

Emanuel Popovici, Electrical and Electronic Engineering, University College Cork

Q&A, discussion round

2. Smart Systems for Environment Monitoring and Biomedical Applications

Carmen Moldovan, IMT Bucharest

Q&A, discussion round

3. Nanomaterials Enabling Smart Energy Harvesting for Next-Generation Internet-of-Things

Mircea Modreanu, Tyndall National Institute, University College Cork

Q&A, discussion round

Name: Dr. Emanuel M. Popovici
Position: Senior Lecturer
Affiliation: Electrical and Electronic Engineering, University College Cork

Emanuel Popovici is a Senior Lecturer with the Department of Electrical and Electronic Engineering, University College Cork. He is currently the Director of the award-winning Embedded.Systems@UCC group. His research interests include embedded system design for reliable and secure computing and communications, hardware accelerators for AI/ML and security with particular emphasis on the EDGE. His research group achieved more than 50 awards and distinctions, including three times winners in the prestigious Global IEEE/IBM Smarter Planet Challenge, Best Engineering Lab in Ireland, Best Collaboration Achievements, Best paper awards(IEEE/IET), student competitions, entrepreneurial awards, etc. His research is inspired by George Boole (the first Professor of Mathematics at UCC) and Claude Shannon (a renowned Professor at MIT).

Title: Artificial Intelligence(AI) and Internet of Things(IoT) technologies for improving healthcare access for disadvantaged communities

Abstract: Access to healthcare is affecting disproportionately disadvantaged communities across the World. Various reports from the EU, UN, WHO highlight this discrepancy, which has severe consequences for those communities in terms of morbidity and mortality. Some examples of conditions which can have a devastating effect if not detected in time include brain seizures or congenital heart disease. Lack of trained personnel who can interpret the brainwaves (electroencephalograms) or heart sounds(phonocardiograms) and/or lack of expensive equipment is often mentioned even in more developed settings as causes for concern.

This presentation addresses some potential mitigation of these shortcomings by using advances in the internet of things and AI technologies to detect seizures and congenital heart disease in neonates. It is shown that these low-cost technologies can achieve high impact without disrupting the existing hospital protocols while used by medical professionals as pre-screening. More importantly, medical professional empowered by AI performs better than those using AI alone. Finaly, some implementation results on internet of things resource constrained platforms for an AI-driven auscultation for congenital heart disease and AI-driven sonification of brainwaves will be presented.

Special thanks to my colleagues: Prof. Andriy Temko; Dr. Andreea Factor; Prof Viktoria Shelevytska, Dr. Sergi Gomez Quintana, Feargal O'Sullivan, Tien Van Nguyen, Giuseppe Carracciolo, Prof. Volodymyr Sarana as well as our supporters(SFI -Insight Centre, Qualcomm, Dell, Analog Devices).

Name: Carmen Moldovan
Position: Director of the Research Center for Integration of Technologies (CINTECH)
Affiliation: National Institute for R&D in Microtechnologies (IMT-Bucharest)

Dr. Carmen Moldovan graduated on Electronics and Telecommunications at Politehnica Bucharest and holds a PhD in Microelectronics. She has joined IMT Bucharest in 1996 working on development of chemosensors and biosensors, implantable micro-nanoelectrodes and neuronal microprobes, nanowire transistors, M(N)EMS, BioMEMS, microfluidics signal processing and micro-nanosystems integration, for different applications. Carmen is/ was leading/ participating in more than 20 EU projects and more than 35 National projects and her scientific activity was published in more than 120 papers and she holds 8 Patents.

TITLE: Smart Systems for Environment Monitoring and Biomedical Applications

Abstract: Environment monitoring represents a stringent necessity under the drastic conditions of Climate change and the increased pollution of the environment (air, water, food) in the big cities but also in small vilages; On the other side, Biomedical devices, pacients monitoring, and health care system represent the botleneck of citizen wellbeing, of medical services and at the end of the economy.
Approaching these two important sectors, environment and biomedical, by advanced micro nanotechnology devices and systems we expect: a) to increase connections with industry and enhance cooperation with business actors for commercialization of environmental monitoring technologies with a special focus on air monitoring; b) to reinforce dialogue with end-user associations, policy makers, investors, and society; c) to offer technologies and devices and systems, IoT connected ready to use for monitoring and remediation of the air/water, d) to design and fabricate new, miniaturized, portable/wearable devices and systems for patients, medical centers, family doctors in order to measure, monitor, advertise on different diseases in an early stage; e) to help remediation of people disabilities by implantable devices; f) to increase areas such as the data analysis, communication, robots, human-machine interfaces. The extended presentation will detail some results already achieved or expected and will figure out future developments.

Name: Mircea Modreanu
Position: Principal Investigator
Affiliation: Tyndall National Institute-University College Cork

Mircea Modreanu is a Principal investigator at Tyndall National Institute-University College Cork. His research interest cover nanomaterials development for micro-nano electronics, nanophotonics, and RF/microwave/ millimeter-wave/ systems for targeted wireless/energy-harvesting application. Currently, he is the Project Coordinator of European Innovation Council FETProactive project "Nanomaterials Enabling Smart Energy Harvesting For Next-Generation Internet-Of-Things" (www.nano-eh.eu). He is also involved in Horizon Europe Net4Air, an EC-funded Twinning action with IMT-Bucharest. His track recorded include over 10 research grants (7 from EC and 3 Irish); chair of 10 international conferences in the area of optical spectroscopies for advance material and devices characterization (8 in Europe and 2 in Japan), 170 per-review papers and three patents application.

Title: Nanomaterials Enabling Smart Energy Harvesting for Next-Generation Internet-of-Things

Abstract: Since 2006 devices autonomously exchanging information have outnumbered humans connected to internet worlwide . Communication among devices has served the aim of enabling cooperative behaviors as reactions to external stimuli or events, from evaluation of alerts to concerned actions following changes of enviromental conditions. The **4th Industrial Revolution** (**4IR**) builds on the **Internet-of-Things** (**IoT**) paradigm, as it relies upon the scenario of having billions of interconnected autonomous mobile devices, with unprecedented processing power, storage capacity and access to knowledge. While enabling such massive deployment, the **4IR** should be increasingly eco-friendly. The **4IR** is a disrupting approach that will force companies in almost every domain to re-organize themselves in a more efficient way, by exploiting technological breakthroughs such us artificial intelligence (AI), wireless communication and quantum computing. The integration of these emerging technologies into every day life requires efficient power supply solutions in computing, sensing, memory enlargement and human-machine interaction. Connected devices may be simple sensing nodes in a network or may be sensing and actuating elements of complex nets, and are further deployed in most diverse fields, from medical diagnostics to security, from predictive maintenance to environmental safety (ambient and infrastructure monitoring) and from industrial automation to intelligent transportation systems till many kinds of daylife activity. One perceived bottleneck for **4IR** is that in most situations, IoT devices/networks will be remotely deployed, so that maintenance may be either incovenient or impossible. Consequently, a foundational aspect for the successful deployment of **4IR** is that IoT nodes operates maintenance-free over their whole predicted lifetime. In particular, this implies that IoT devices either have to embed energy sources consistent with their operative lifespan or that clean and renewable energy convertors, if working off-grid, must sit on board. In this talk a *More-than-Moore* technological platform **primarily** exploits the abundant clean source of always-on RF energy over an extended spectrum range (2G/3G/Wi-Fi/5G) while integrating on-chip energy storage functionalities will be discussed

9:00-10:45 ➢ Session 6:

Innovation at the Frontier between Chip and Assembly. Chiplet

Today, literature in the microelectronic domain is facing an important topic- the chiplet. In a very interesting article, https://octopart.com/blog/archives/2022/08/what-are-chiplets-and-how-are-they-used-in-packaging, it is explained the reasons that led to the chiplet technology. Some remarks: "Cost and performance are the two most pressing issues in chip design and manufacturing. The only way to increase the number of integrated functional units, with the same transistor size is to expand the chip area, either in the device plane or vertically". Unfortunately, the previously mentioned solution to increasing the chip area is coming with some disadvantages like more susceptibility to manufacture defects and with increasing the product price. It is obvious that under these circumstances the monolithic chips are becoming increasingly incapable of providing the desired performance according to computer demand. Consequently, to avoid the disadvantages mentioned, a more and more present technology is the chiplet technology. Multiple chiplets are combined using proper interfacing techniques to create a larger IC as an alternative to a monolithic structure.

The session is trying to present and to discuss some aspects regarding chiplet technology, a technology with a positive impact on Intellectual Property issues too.

Chairs: Paul Svasta (UPB),
Cosmin Moisa (Continental Automotive)

1. *The Software-defined Vehicle and Its Effects on Vehicle Architecture*
   Christian von Albrichsfeld, Continental Automotive
   Q&A, discussion round

2. *Beyond Moore's Law: Leveraging Advanced Packaging Technology*
   Cătălin Ciobanu, UTBv
   Q&A, discussion round

3. *High-Performance Computing in the Netherlands: Overview and developments*
   Valeriu Codreanu, SURF
   Q&A, discussion round

Name: Christian von Albrichsfeld
Position: Country Head and R&D Head
Affiliation: Continental Romania

Christian von Albrichsfeld graduated at the Technical University in Darmstadt, Germany in 1992 and received a doctoral degree in robotics and artificial intelligence from the same University in 1997.
In the same year he joined the technology company Continental, being today one of the most important suppliers for the automotive industry worldwide, where he worked in research projects and in the technical management for innovative automotive systems.
Since 2009 he is the General Manager of Continental Automotive Romania, representing also as Country Head Continental in Romania, coordinating it's activities with currently more than 19.000 employees in Timisoara, Sibiu, Brasov, Nadab, Carei and Iasi at national level. At the same time he is the manager for Research and Development. In 2012 he received the title of Honorary Professor of the Polytechnic University Timisoara. He is vice president of the German Economic Club Banat, vice president of the Executive Board of the Polytechnic University of Timisoara and vice president of the German-Romanian Chamber of Industry and Commerce.
2018 and 2022 he was awarded CEO of the Year by Automotive Today and The Diplomat. He received the Forbes Business Award 2017 and was nominated Forbes Business Hero 2020 and Forbes Personality of the Year 2021 in the Domain Auto. In 2023 he was awarded the title Dr. honoris causa by the Polytechnic University Timisoara. He is permanently engaged in the collaboration between economic and educational institutions, a collaboration which not only has a scientific component, reflected in research and development but also an institutional one for improving the educational academic system and its' adaptation to global standards. His commitment to education has also extended to the undergraduate level, being one of the initiators for reintroducing vocational schools in Romania, a project in which Continental is a partner of the pilot classes in Timisoara, Carei, Brasov and Sibiu, being also member of the German-Romanian Steering Committee for dual professional education.

Title: The Software-defined Vehicle and Its Effects on Vehicle Architecture

Abstract: Changes in technology, sociologic megatrends, as urbanization, aging population, and socio-political trends as green and sustainable mobility are marking the directions in the automotive industry. Megatrends like connected cars, autonomous driving vehicles, shared mobility and electric cars lead to vehicles which will be defined by functionality and software. Cars will become part of a mobility ecosystem. This is leading to a transformation of the vehicle architecture implemented in current series vehicles: A patchwork architecture where functionalities are isolated in up to 100 ECUs with individual interfaces and a lot of cabling ensuring the electric and electronic connection is going to be replaced by a function-defined architecture with few high performance computers and zone computers, with standardized interfaces, where the cabling will be halved.
The presentation will describe after a short overview of the megatrends this development in more details.

Name: Ciobanu Cătălin Bogdan
Position: Lecturer
Affiliation: Transilvania University of Brașov

Cătălin Ciobanu has a 5-year engineering degree from Transilvania University of Brașov, graduating in 2006. He obtained a Master of Science in 2007 and a PhD in Computer Engineering in 2013 from Delft University of Technology, The Netherlands. He continued as a PostDoc at Chalmers University of Technology and as a researcher at University of Amsterdam. Since 2020 mr. Ciobanu is affiliated with Transilvania University of Brașov

Title: Beyond Moore's Law: Leveraging Advanced Packaging Technology

Abstract: The semiconductor industry is facing new challenges due to multiple constraints in advanced chip design. Power and thermal limitations as well as limited Instructions Per Clock (IPC) gains in new generations of processors have pushed the industry towards multicore designs as well as the wide use of accelerators. Furthermore, the wafer costs for each new technology node are rising with new generation. For high-performance processors, monolithic designs are prohibitively expensive due to lower yields inherent to large chips. The dies of high-end GPUs approach the reticle limit. Moreover, scaling to new process nodes does not decrease the silicon area of analog and SRAM by the same amount as for digital logic. Therefore, the industry is shifting towards advanced packaging techniques such as Intel's Embedded Multi-Die Interconnect Bridge (EMIB) and Foveros die to die stacking. Intel is using EMIB to connect four CPU tiles in their Sapphire Rapids (SPR) CPUs. Furthermore, the SPR tiles can also use High Bandwidth Memory (HBM) attached to the CPU tiles using EMIB. Intel employs 47 tiles in their Ponte Vecchio Accelerator, amounting to 2330 mm^2 of silicon. Ponte Vecchio uses both EMIB and Foveros. AMD has been employing chiplets for their Ryzen and EPYC CPUs for several generations. AMD's 3D V-Cache technology employs 3d stacking, tripling the L3 cache capacity from 32MB to 96MB on their CPU chiplets. A Zen4 7800x3D Ryzen CPU has a 6nm I/O die, a 5nm CPU chiplet and a 7nm V-cache SRAM chiplet. For their GPUs, AMD's RDNA3 GPU features a 5nm Graphics Compute Die (GCD) and a 6nm Memory Cache Die (MCD), benefitting from mixing different technology nodes in the same GPU.

Name: Dr.ing. Codreanu Valeriu
Position: Head of High-Performance Computing and Visualisation
Affiliation: SURF (Samenwerkende Universitaire RekenFaciliteiten, Cooperating Academic Computing Facilities)

Valeriu Codreanu studied Electrical Engineering and got his MSc at the Polytechnic University of Bucharest. He followed-up with a PhD in Computer Architecture at the same institute, graduating in 2011. Valeriu continued as a researcher at Eindhoven University of Technology and University of Groningen, working on GPU computing, computer vision, and embedded systems. In 2014, he joined SURFsara as an HPC consultant and in 2016 became the PI of an Intel Parallel Computing Center project on 'Scaling up Deep Learning'. Valeriu is currently leading the High-Performance Computing and Visualization group at **SURF**, responsible for the Dutch National Supercomputing infrastructure.

Title: High-Performance Computing in the Netherlands: Overview and developments

Abstract: This presentation will provide an overview of the HPC ecosystem in the Netherlands, with a focus on the work being done by SURF, the Dutch cooperative for ICT in higher education and research. SURF has the role of National HPC Center in the Netherlands, and is a key player in the European HPC landscape, providing researchers and scientists with access to powerful supercomputing resources and driving innovation in HPC technology and applications.

One of SURF's most significant contributions to the HPC community is the Snellius supercomputer, a state-of-the-art system that is one of the most energy-efficient and cost-effective HPC solutions in the world. The talk will highlight the features and capabilities of the Snellius supercomputer, including its use of innovative chiplet technology to achieve high performance and energy efficiency.

The presentation will also discuss the wider impact of chiplets on modern supercomputing, exploring the benefits and challenges associated with this new technology. Attendees will gain insights into the latest trends and innovations in HPC, and learn how organizations like SURF are leveraging cutting-edge technologies to drive progress in HPC research and innovation.

11:30-13:45 ➢ Special Session organized by Romanian Ministry of Economy

Romania's Vision for and Expectations from the European Chips Act

Chairs: Eng. Daniel Bucur (Ministry of Economy),
Prof. Adrian M. Ionescu (EPFL, Lausanne, Switzerland)
Dr. Andreas Wild (Commission for Science and Technology of Micro Systems, Romanian Academy)

13:45-17:30 ➢ ***Visit to Continental Automotive Romania***

13:45-14:15 Relocation to Continental Automotive Romania, Siemens Str. 1, Building A Extension
14:15-14:30 Welcome by Continental Management Team, Room A6.153.

14:30-15:00➢ *Socializing Lunch* 30 min

15:00-16:15 Visit at Continental Facilities (Group 1 for R&D / Group 2 for Plant)
Guiding coordinators Focus Factories: Lucian Margineanu, Petru Demian, Liviu Almăjan
16:15-17:30 Visit at Continental Facilities (Group 2 for R&D / Group 1 for Plant)
Guiding coordinators R&D: Ciprian Bleoju, Andrei Son, Cosmin Moisa
17:30 Relocation to UPT

April 13, 2023

09:00 – 11:00 Wrapping-up session

UPT Conference Center, Vasile Parvan Boulevard 2B (Auditorium Room)

Chairs: Dan Lascu (UPT), Cosmin Moisa (Continental Automotive)

11:00 – 13:00 Overall event conclusions

(UVT Aula Magna, Vasile Parvan Boulevard 4)

13:00 Trip to Recas Wineyard

Participants

(In alphabetical order)

- von Albrichsfeld Christian, Continental Automotive Timișoara
- Anghel Lorena, Grenoble Institute of Engineering and Management (INP)
- Banu Viorel, CNM-IMB CSIC Barcelona
- De Boeck Jo, IMEC
- Bonfert Detlef, Fraunhofer EMFT München
- Brezeanu Gheorghe, University Politehnica of Bucharest
- Bucur Daniel, Ministry of Economy Romania
- Buiu Octavian, IMT Bucharest
- Burileanu Corneliu, University Politehnica of Bucharest
- Chindris Gabriel, Technical University of Cluj-Napoca
- Ciobanu Cătălin, Transilvania University of Brașov
- Ciorbă Dumitru, FCIM, UTM, Md
- Codreanu Valeriu, Surf
- Comeagă Daniel, University Politehnica of Bucharest
- Costinescu Bogdan, NXP Romania
- Cracăn Arcadie, Gheorghe Asachi Technical University of Iași
- Cucu Traian, Ametek
- Dan Claudius, University Politehnica of Bucharest
- Dan Petru, STMS Commission, Romanian Academy
- Drăghici Florin, University Politehnica of Bucharest
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- Factor Andreea, University College Cork
- Graur Adrian, Stefan cel Mare University of Suceava
- Ionescu Adrian, EPFL, CH
- Jajaie Anda, University Politehnica of Bucharest
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- Vișan Traian, Infineon România
- Wild Andreas, AWK Germany

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