Huawei Future Device Technology Summit Program

October 9-11, 2023
Hilton Kalastajatorppa, Helsinki
FINLAND

2023
Aurora
Summit

HUAWEI

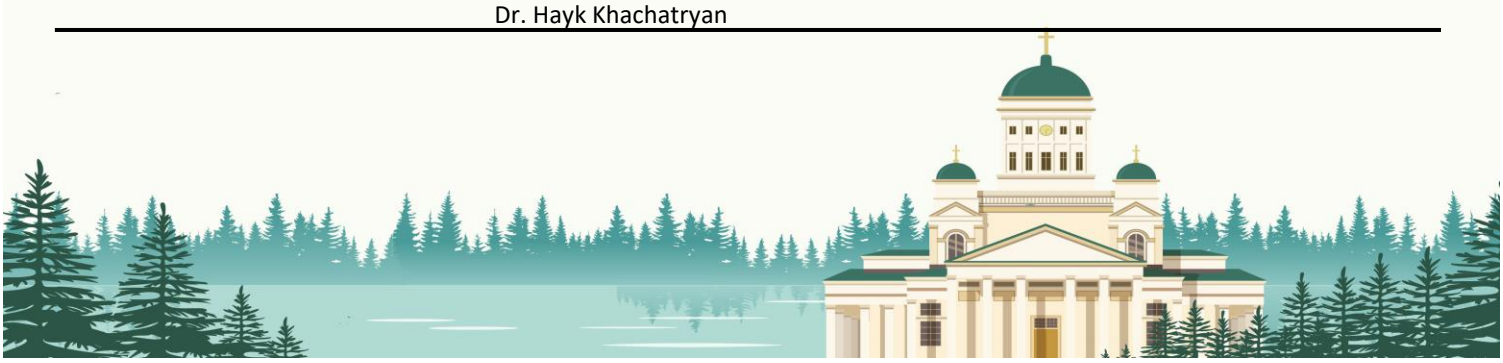
Huawei Future Device Technology Summit

October 9-11, 2023| Helsinki, Finland

9th of October 2023 | DAY 1 | Room: Stateroom II

AGENDA

	07:30-08:10	**Registration Desk Open**
	08:10-08:15	**Welcome Words** Dr. Hayk Khachatryan
	08:15 - 08:30	**Huawei Opening Speech** Mr. Jia Xu, President of Huawei Finland Research Center
Thermal Dissipation Technology 散热技术	08:30– 09:15	**Fabrication of Heat Pipes and Heat Sinks Using Thermal Spray** Prof. Sanjeev Chandra, University of Toronto, Canada
	09:15-10:00	**Wetting and Phase-Change on Micro-decorated Surfaces and on High Aspect Ratio Microchannels** Prof. Daniel Orejon, University of Edinburgh, UK
	10:00 – 10:30	**COFFEE BREAK**
	10:30-11:15	**Experimental Characterization and Mathematical Modelling of Micro and Miniature Loop Heat Pipes** Prof. Manmohan Pandey, Indian Institute of Technology Guwahati, India
	11:15-12:00	**Multi-scale Models of Polymeric Composites and Colloidal Suspensions for Enhanced Heat Transfer** Prof. Matteo Fasano, Politecnico di Torino, Italy
	12:00-13:30	**LUNCH**
	13:30-14:15	**Nanofluids, Preparation, Selection Rules, Modeling as a One-phase Cooling Heat Transfer Fluid and Thermal Management for Consumer Electronics** Prof. Mohsen Sharifpur, University of Pretoria, South Africa
	14:15-15:00	**Improving The Cooling Performance Through Self-adaptive Components for Non-uniform and Time Dependent Heat Loads** Prof. Jérôme Barrau, University of Lleida, Spain
	15:00-15:30	**COFFEE BREAK**
	15:30-16:15	**Ionic Liquids and Nanomaterials as New and Sustainable Heat Transfer Fluids for Electronics Cooling** Prof. Carlos Nieto de Castro, Universidade de Lisboa, Portugal
	16:15-17:00	**PANEL DISCUSSION**
	17:00-17:05	**Day Close** Dr. Hayk Khachatryan



9th of October 2023 | DAY 1 | Room: Stateroom I

AGENDA

	07:30-08:10	**Registration Desk Open**
	08:10-08:15	**Welcome Words** Mr. Petri Kainiemi
	08:15 - 08:30	**Huawei Opening Speech** Mr. Jia Xu, President of Huawei Finland Research Center
Graphics Technology 图形技术	08:30– 08:35	**Huawei Talk** Mr. Ti Gong, President of Huawei Consumer Business Group
	08:35– 09:20	**Digital Typography** Prof. Nicolas P. Rougier, INRIA, France
	09:20-10:05	**Rust for Rendering Engine** Mr. Jasper Bekkers, Traverse Research, Netherlands
	10:05 – 10:30	**COFFEE BREAK**
	10:30-11:15	**Fully Interactive Rive Boot Animation Drawn with a Custom Renderer** Mr. Dragos Tiselice, Rive, Romania
	11:15-12:00	**Blend2D - High Performance 2D Graphics Engine** Mr. Petr Kobalíček, Sneller, Czech
	12:00-13:30	**LUNCH**
	13:30-14:15	**A Case Against Cross Platform Graphics System Library for Mobile Development** Dr. Kevin Rogovin, Procreate, USA/Finland
	14:15-15:00	**HypeHype Mobile Rendering Architecture** Mr. Sebastian Aaltonen, HypeHype, Finland
	15:00-15:30	**COFFEE BREAK**
	15:30-16:15	**Driving Innovation in Embedded Systems with Open Source Technologies** Mr. Andres Gomez, Igalia, Spain/Finland
	16:15-17:00	**PANEL DISCUSSION**
	17:00-17:05	**Day Close** Mr. Petri Kainiemi

10th of October 2023 | DAY 2 | Room: Stateroom II

AGENDA

	07:30-08:25	**Registration Desk Open**
	08:25-08:30	**Welcome Words** Mr. Siqi Hao
Health and Sport technology 健康与运动技术	08:30-09:15	**Integration of Smartwatch Data for Novel Healthcare and Costumers Applications** Prof. Luca Mainardi, Politecnico di Milano, Italy
	09:15-10:00	**Blueprint for A Next-generation Blood Pressure Measurement Device** Prof. Teemu Niiranen, Turku University Hospital and University of Turku, Finland
	10:00-10:30	**COFFEE BREAK**
	10:30-11:15	**Advancing Health Assessment through Synthetic Pulse Wave Data** Dr. Jordi Alastruey, King's College London, UK
	11:15-12:00	**Digital Biomarkers for Health Promotion and Prevention: Extracting Actionable Insights from Real-world Data** Prof. Lorenzo Chiari, University of Bologna, Italy
	12:00– 13:30	**LUNCH**
	13:30-14:15	**Laser Doppler Spectrum Decomposition and Time-frequency Analysis: from Fibre-optics to VCSEL-based Microvascular Disease Monitoring** Dr. Evgenii Zherebtsov, University of Oulu, Finland
	14:15-15:00	**Towards Pervasive Health Management With Wearable Sensors – Where We Stand?** Prof. Ilkka Korhonen, Tampere University, Finland
	15:00-15:30	**COFFEE BREAK**
	15:30 - 16:15	**Scientific support for Finnish National Cross-Country Skiing Team** Dr. Esa Hynynen, Olympic sports Institute Finnish Institute of High Performance Sport, Finland
	16:15 -17:00	**Physics-based Computational Modeling and Simulation for the Development of Health applications** Prof. Lennart Scheys, KU Leuven Institute
	17:00 -17:05	**Day Close** Mr. Siqi Hao

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10th of October 2023 | DAY 2 | Room: Stateroom I

AGENDA

	07:30-08:15	**Registration Desk Open**
	08:10-08:15	**Welcome Words** Dr. Jan Erik Ekberg
Session I	08:15-08:20	**Huawei Talk** Mr. Ti Gong, President of Huawei Consumer Business Group
System Security	08:20-09:00	**Improving Cloud Security with Hardware Capabilities** Prof. Peter Pietzuch, Imperial College London, UK
系统安全	09:00-09:40	**Trustworthy Accelerated Devices** Prof. Pramod Bhatotia, TUM, Germany
	09:40-10:10	**COFFEE BREAK**
	10:10-10:50	**Security of Networked Systems - Current and Future Directions for Research** Prof. Seppo Virtanen, University of Turku, Finland
	10:50-11:30	**Tagged Pointer-Based Capability Model: Security and Performance Trade-offs and the Role of Software** Dr. Myoung Jin Nam, Kings Collage London, UK
	11:30-12:10	**Securing Linux-based RISC-V Devices with CHERI** Dr. Julian Horsch, Fraunhofer AISEC, Germany
	12:10-13:30	**LUNCH**
	13:30-14:10	**FlexOS - Making OS Isolation Flexible** Dr. Hugo Lefeuvre, The University of Manchester, UK
	14:10-14:50	**IRShield: How to Counter Privacy Threats of Wireless Sensing** Dr. Paul Staat, Max Planck Institute for Security and Privacy Bochum, Germany
Session II	**14:30-15:00**	**COFFEE BREAK**
Cloud Security & AI	15:00-15:05	**Welcome Words** Mr. Kuan Eeik Tan
云安全与AI	15:05-15:45	**Secure Location Sharing Protocol** Prof. Valtteri Niemi, Helsinki University, Finland
	15:45-16:30	**A Decade of Research in Speech Deepfakes and Anti-spoofing: Lessons Learnt and Future Challenges** Prof. Tomi Kinnunen, University of Eastern Finland, Finland
	16:30-16:45	**COFFEE BREAK**
	16:45-17:25	**Towards Detailed Understanding of The Visual World** Prof. Fahad Shahbaz Khan, MBZUAI, Abu Dhabi/ Linköping University Sweden, Abu Dhabi/ Sweden
	17:25-18:05	**Unmasking Deception: Harnessing AI and Machine Learning in the Battle Against Disinformation** Prof. David Camacho, Technical University of Madrid, Spain
	18:05-18:10	**Day Close** Mr. Adrian Flanagan

11th of October 2023 | DAY 3 | Room: Stateroom II

AGENDA

	07:30- 08:25	**Registration Desk Open**
	08:25- 08:30	**Welcome Words** Dr. Zlatoljub Milosavljevic
Antenna & Filter 天线和滤波器	08:30 – 09:15	**On-Body Antenna Modelling and Optimization** Prof. Dirk Manteuffel, Institute of Microwave and Wireless Systems, Germany
	09:15-10:00	**Small Antennas and Circularly Polarized (CP) Antennas** Prof. Miguel Ferrando Bataller, Universitat Politècnica de València, Spain
	10:00 – 10:30	**COFFEE BREAK**
	10:30-11:15	**Overcoming The Human Body in our Wireless Solutions** Dr. Gareth A. Conway, Queen's University of Belfast, Institute of Electronics, Computing and Information Technology (ECIT), Centre for Wireless Innovation (CWI), Northern, Ireland, UK
	11:15-12:00	**Advanced Metasurfaces for Antenna Applications** Prof. Sergei Tretyakov, Aalto University, Finland
	12:00-13:30	**LUNCH**
	13:30-14:15	**Growth of Alkaline Films for High-frequency BAW And SAW Devices** Prof. Ausrine Bartasyte, University of Franche-Comté, Deputy Director of FEMTO-ST Institute, France
	14:15-15:00	**Advancements In Piezoelectric Materials for High-frequency Acoustic Filters** Prof. Oliver Ambacher, Albert-Ludwigs-University, Institute for Sustainable Systems Engineering (INATECH), Gips-Schüle Chair for Power Electronics, Germany
	15:00-15:30	**COFFEE BREAK**
	15:30-16:15	**Acoustic Wave Technological Feasibility by Filter Synthesis Methodologies** Dr. Pedro de Paco & Prof. Jordi Verdu, UAB, Spain
	16:15-17:00	**Latest Synthesis Techniques for Microwave Filters Used in Advanced Communication Systems** Prof. Giuseppe Macchiarella, Fellow IEEE, Politecnico di Milano
	17:00-17:05	**Day Close** Dr. Zlatoljub Milosavljevic

11th of October 2023 | DAY 3 | Room: Stateroom I

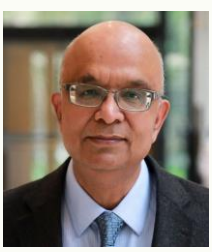
AGENDA

	07:30- 08:55	**Registration Desk Open**
	08:55- 09:00	**Welcome Words** Mr. Kalle Koivuniemi
Audio 音频	09:00 – 09:45	**Controllable Speech Enhancement with Meta L earning for Optimal Filters** Prof. Jesper Rindom Jensen, Aalborg University, Denmark
	09:45-10:30	**Latest Research and Future Perspectives in Immersive Audio Over Headphones** Prof. Lorenzo Picinali, Imperial College London, UK
	10:30 – 11:00	**COFFEE BREAK**
	11:00-11:30	**Natural Language Guided Audio Generation: Technologies and Applications** PhD Student Haohe Liu, University of Surrey, UK
	11:30-12:00	**Pushing Audio Boundaries: Explorations and Innovations with Multi-Channel Modulo ADC Technology** PhD Student Wenyi Yan, Brunel University London, UK
	12:00-13:30	**LUNCH**
	13:30-14:15	**Shaping The Hearing With Hearables – Elevating Ambient Sounds, Own Voice, and Spatial Content.** Dr. Stefan Liebich, Elevear GmbH, Germany
	14:15-15:00	**Unleashing the Potential of Sensor-Based Processing with AI-Enhanced Products** Mr. Aleksandr Timofeev (CEO) & Mr. Serge Kozhanov, PolyN Technology, Israel
	15:00-15:30	**COFFEE BREAK**
	15:30-16:30	**Startup Demo** SonicEdge, Israel
	16:30-17:30	**Startup Demo** Ai-coustics, Germany
	17:30-17:35	**Day Close** Mr. Kalle Koivuniemi

Speech on 9th of October, State Room II, Thermal Dissipation Technology

Prof. Sanjeev Chandra

University of Toronto, Canada



Sanjeev Chandra is a Professor in the Department of Mechanical and Industrial Engineering (MIE) at the University of Toronto, which he joined in 1990 after receiving his Ph.D. from Cornell University. Prof. Chandra is known internationally for his research on the dynamics of droplets and sprays and is one of the founders of the Centre for Advanced Coating Technologies at the University of Toronto. His research spans the areas of fluid mechanics, heat transfer and materials science and has also been applied in spray coating, spray cooling, spray painting, ink-jet printing, electronic cooling and waste heat recovery. Prof. Chandra has published over 300 papers in referred journals and international conference proceedings. He was awarded the The Brockhouse Canada Prize for Interdisciplinary Research in 2010 by the Natural Sciences and Engineering Research Council of Canada to recognize outstanding collaborative research. He received the Jules Stachiewicz Medal for heat transfer in 2015 and the Robert W. Angus Medal for the management and practice of mechanical engineering in 2020, both awarded by the Canadian Society for Mechanical Engineering. He received the Classic Paper Award from the American Society of Mechanical Engineers in 2019. Professor Chandra was a Fellow of the Centre of Smart Interfaces at the University of Darmstadt in 2011 and the Tan Chin Tuan Exchange Fellow at Nanyang Technological University in 2018. He is a Fellow of the Canadian Academy of Engineering, the American Society of Mechanical Engineers, the Canadian Society for Mechanical Engineering and the American Association for the Advancement of Science. Prof. Chandra teaches undergraduate and graduate courses on thermodynamics and heat transfer and was awarded the Sustained Excellence in Teaching Award by the MIE Department. He has written an undergraduate textbook on thermodynamics and several chapters for books on thermal spray coating, heat transfer and sprays. He has served as visiting professor at the University of Limoges (France), Korea University (S. Korea), the University of Bremen (Germany), the University of Darmstadt (Germany), Nanyang Technical University (Singapore) and the University of Brighton (UK).

Topic: Fabrication of Heat Pipes and Heat Sinks Using Thermal Spray

Increasing power dissipation by electronic devices requires significant improvements in the technologies used to cool them, such as heat pipes and water-cooled heat sinks. Novel designs have been proposed for high-efficiency devices with complex geometries, but these are difficult to manufacture using traditional methods. Additive manufacturing techniques such as Selective Laser Sintering have been employed, but these are slow and expensive. Thermal spray is a process in which a coating material (metal, ceramic or polymer) is melted in a high velocity gas jet and sprayed onto a surface. It is widely used to apply protective coatings but can also be used as a rapid, low-cost, additive manufacturing technique to make heat pipes and heat sinks. A large, flat copper heat pipe was made by brazing together the edges of two square copper plates (each 180 mm x 180 mm) to form a 3 mm thick enclosure. A porous copper wick was deposited on the inner surface of one plate prior to brazing by spraying a mixture of copper and aluminium powders onto it and placing the resulting coating in a sodium hydroxide solution that dissolved the aluminium. The enclosed volume between the plates was evacuated and partially filled with water to form a heat pipe that was very effective in spreading heat over a large area. Thermal spray was also used to make other thin, porous wicking structures, including by spraying metal on porous polymers and on wire meshes.Optimized, water-cooled heat sinks were made with 1 mm high internal flow channels. Topology optimization was used to generate a geometry for flow passages that maximized heat transfer while also minimizing the temperature non-uniformity. A polymer mask was made by 3D printing with openings where the topology optimization model placed structures in the flow path. The mask was placed in a recess machined in an aluminum plate and aluminum sprayed over it. The mask was removed, the sprayed structures ground to a uniform height of 1 mm, and the top of the recess sealed by spraying metal. Tests showed that when a heat flux was applied the average temperature of the optimized cold plate and temperature gradients across it much lower than for a conventional cold plate with parallel channels.

Speech on 9th of October, State Room II, Thermal Dissipation Technology

Prof. Daniel Orejon

University of Edinburgh, UK

Daniel Orejon (Dani) holds a 5-year bachelor's degree in Environmental and Industrial Chemical Engineering from the University of Seville (Spain). After graduating, Dani spent a year as Graduate Research Assistant at the Institute for Energy Systems at the University of Edinburgh (UoE) and thereafter he completed his PhD on the fundamentals of evaporation phase-change at the droplet scale at the Institute for Materials and Processes at the UoE in 2013. Right after, Dani joined the International Institute for Carbon-Neutral Energy Research (WPI-I2CNER) at Kyushu University in Japan as a Post-Doctoral Research Associate where he shifted his research efforts towards condensation. In 2016, he became Assistant Professor at I2CNER Kyushu University (Japan) and 2 years later he joined the Institute for Multiscale Thermofluids (IMT) at the UoE as a Lecturer. Dani is currently a Senior Lecturer and serves as School Postgraduate Progression Committee representative for the IMT and as Teaching Laboratory Manager for the Chemical Engineering Discipline. In addition, Dani has been appointed as WPI-I2CNER Visiting Associate Professor, Associate Editor for the International Journal of Heat and Mass Transfer, and Fellow of the Higher Education Academy.Dani's research interests embrace interfacial phenomena between liquid films/droplets and solid surfaces paying special attention to the effect of surface wettability and structure, liquid nature and surrounding environment on the fundamentals mechanisms of wetting and spreading encompassing evaporation and/or condensation phase-change. He focuses on the relevant interactions at different length-scales from the micro- to the nano-scale as well as on the thermophyiscal properties of all three solid, liquid and gas phases present, for interfacial mass and thermal transport related applications. Dani received the Young and Early-Career Scientists Kakenhi award twice, has received a Royal Society Research Grant and a University Strategic Collaboration Award between UoE and University of Rice. Dani also took part in the SciSpacE Microgravity Application Promotion Programme from the European Space Agency (ESA).

Topic: Wetting and Phase-Change on Micro-decorated Surfaces and on High Aspect Ratio Microchannels

The interactions between liquid droplet/films and solid surfaces are ubiquitous and intrinsic to everyday domestic and industrial applications, which include thermal management of portable electronics, water treatment and harvesting, energy generation, etc. The aim of this talk is two-fold. On one hand, it introduces the fundamental effect of ambient exposure on the wettability and phase-change of pure water, pure ethanol and their binary mixtures on intrinsically hydrophilic micro-structured surfaces. The use of water-ethanol binary mixture allows to access a wide range of surface tensions while Deep Reactive Ion Etching was utilized to fabricate a wide range of surface structures varying in the spacing between them, i.e., different solid fractions, with very accurate precision. More specifically we look at the effect of ambient exposure and the gradual increase on the amount of volatile organic compounds adsorbed onto the structured surfaces, which modify their intrinsic hydrophilicity from complete wetting to less- wetting. Such fundamental effect of ambient exposure on the liquid-surface interactions shall be considered when designing thermal management devices open to the environment or in the presence of non-condensable gases. On the other hand, for high aspect ratio micro-channels for flexible and portable electronics cooling, the channel orientation and inclination play a paramount role on the thermal management efficacy during multiphase flow boiling. Both the bubble dynamics, pattern flows as well as temperature profiles during the heat transfer performance of different low boiling temperature organic fluids such as Hydrofluoroether (HFE−7000) and Perfluorohexane (FC-72) as well as water, are investigated for different mass flowrates varying between 10 and 42 kg/m2/s and heat fluxes up to 20 kW/m2. Reported flow instabilities ease the cooling performance of the channel while the strength of such instabilities is function of the working conditions such as mass flux, heat flux and channel inclination. In this part of the talk the the effect of channel inclination as well as orientation on the different bubble flow and cooling behavior on a high aspect ratio micro-channel at different mass fluxes and heat fluxes is addressed. In the specific case of Hydrofluoroether (HFE−7000) up to 77 % and 275 % in the single-phase and two-phase regions better heat transfer coefficients are achieved respectively when compared to baseline stable conditions. To sum up, wetting and phase-change mechanisms introduced here suggest promising capabilities for microfluidics, self-cleaning, thermal management as well as condensation phase-change applications.

Speech on 9th of October, State Room II, Thermal Dissipation Technology

Prof. Manmohan Pandey

Indian Institute of Technology Guwahati, India

Manmohan Pandey is a Professor of Mechanical Engineering at the Indian Institute of Technology (IIT) Guwahati, India. He obtained a B.Tech. degree in Mechanical Engineering from IIT Bombay, followed by M.Tech. and Ph.D. from IIT Kanpur. He has worked with the industry for about four years and has a teaching experience of over 22 years. He has taught over ten different courses at undergraduate as well as postgraduate levels. His research interests are in systems involving liquid-vapor phase-change phenomena, viz., miniature channels with flow boiling, miniature/micro- loop heat pipes, thin film evaporation, and two-phase flow instabilities. He has supervised seven doctoral theses and over 30 masters' theses. He has conducted several sponsored R&D projects involving experimental and numerical investigations. He has published over 50 research papers in reputed scientific journals and conference proceedings. He has also delivered keynote and invited talks, and chaired technical sessions and tracks in national and international conferences and symposia. He is a member of the editorial board of the international journal, Science and Technology of Nuclear Installations (Hindawi), and a reviewer of many reputed scientific journals and conference proceedings. He has also served as a member of the board of directors of the American Nuclear Society's India Section.

Topic: Experimental Characterization and Mathematical Modelling of Micro and Miniature Loop Heat Pipes

Miniaturization of power consuming devices used in modern as well as conventional technologies has created the need of removing high heat fluxes, thus necessitating the development of suitable cooling techniques. Our research group is engaged in experimental characterization and mathematical modelling of high heat flux cooling devices involving single-phase and two-phase (evaporation) phenomena. Miniature two-phase cooling systems employ either two-phase capillary cooling devices such as miniature/micro- loop heat pipes (MLHPs) or mechanically pumped fluid loops involving flow boiling in small passages like mini-/micro-channel heat sinks (MCHS). MLHPs belong to a family of thermal superconductors which use the capillary transport phenomenon to transfer heat in a specific direction. We have designed, fabricated and tested a micro LHP and a few miniature LHPs using different working fluids. Development and characterization of various types of wicks for miniature LHPs has been done. Experimental and theoretical investigations on steady-state as well as transient characteristics of MLHPs have been done and are ongoing. The results of their performance testing and mathematical modelling are encouraging. MLHP devices involve thin-film evaporation whose modelling and experimental validation have been of considerable interest. A novel method for estimating the film thickness at the onset of evaporation has been presented, and a new parameter to estimate the performance of two-phase capillary devices has been identified.

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Prof. Matteo Fasano

Politecnico di Torino, Italy

Matteo Fasano is an Associate Professor and co-Director of the Multi-Scale Modelling Laboratory (SMaLL) at Politecnico di Torino in Italy. He received his Ph.D. in Energy Engineering and Nanotechnology from the Scuola Interpolitecnica di Dottorato in 2015, and his doctoral thesis was recognized as the best Ph.D. research by the Energy Department of Politecnico di Torino and by the ENI Award in 2017, which is considered as the most prestigious prize for young Italian scientists in the energy field.Prof. Fasano has international research experience, having been a one-year research fellow at the Houston Methodist Research Institute and a visiting researcher at the Massachusetts Institute of Technology. He has also collaborated with scientists from Imperial College, the University of Minnesota, and Université Claude Bernard Lyon.Since 2014, Prof. Fasano has (co-) authored over 60 publications, including highly cited articles in Nature Communications, Nature Sustainability, and Science Advances. His research focuses on modelling heat and mass transfer in a broad range of applications, including enhanced heat transfer, thermal energy storage, solar energy harvesting, and thermal desalination. He has expertise in various modelling techniques, including atomistic (molecular dynamics, Monte Carlo), mesoscopic (coarse-grained), continuum and system-level modelling techniques, as well as machine learning tools. He is currently involved in four European projects dealing with multiscale simulations of passive cooling materials, thermal recycling processes, and solar thermal desalination systems, and he collaborates with companies in the automotive, space, and energy industries on similar topics.At Politecnico di Torino, Prof. Fasano teaches the courses "Energy applications of materials" and “Advanced topics of Engineering Thermodynamics” for the MSc in Mechanical and Energy Engineering, the course “Modelling of Nanoscale heat and mass transfer phenomena” for the PhD in Energetics, and he is in the management board of the CleanWaterCenter interdepartmental initiative.

Topic: Multi-scale Models of Polymeric Composites and Colloidal Suspensions for Enhanced Heat Transfer

Enhancing thermal transfer in materials through innovative nanostructures is a promising approach with far-reaching implications across industries, particularly in applications such as electronic cooling. This presentation delves into two intertwined case studies: composite materials and colloidal suspensions, utilizing solid and liquid base materials, respectively.Composite materials play a pivotal role in various industries due to their lightweight nature and improved physical properties. Recent advancements have seen these composites incorporating polymeric matrices with nanostructured materials like graphene and carbon nanotubes, renowned for their superior thermal, mechanical, and electrical characteristics. To unravel and optimize thermal transport within these nanocomposites, we employ a multi-scale modeling approach. We initiate with molecular dynamics simulations to evaluate thermal boundary resistance at interfaces and to compute thermal conductivities of the composite constituents. Coarse-grained models provide then insights into particle aggregation, shedding light on phenomena such as thermal percolation. Finally, continuum simulations investigate the conduction shape factor among nanofillers within the polymer matrix at component scale.Shifting our focus to colloidal suspensions, we explore their potential as coolants. By dispersing nanoparticles within traditional fluids, colloidal suspensions exhibit significant enhancements in thermal transport properties, holding promise for improving electronic cooling and thermal energy applications. We present a comprehensive multi-scale modeling approach that encompasses atomistic simulations to gain insights into interfacial properties and particle-particle interactions. Additionally, we employ coarse-grained molecular models to understand particle aggregation and related phenomena, including thermal percolation. Continuum models play a role in predicting macroscopic thermal transport properties, utilizing inputs derived from lower-scale models. In conclusion, our multi-scale models in the domains of composites and colloidal suspensions provide a path towards systematically enhancing thermal transfer in solid and liquid materials, respectively. These innovations hold the potential to enhance performance, efficiency, and reliability across a wide spectrum of energy applications. Looking ahead, the incorporation of recent machine learning techniques promises to further improve the integration of multi-scale models and the development of data-driven models for thermal transfer able to transcend the limitations of physical models alone.

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Prof. Mohsen Sharifpur

University of Pretoria, South Africa

Mohsen Sharifpur is a full professor in the Department of Mechanical and Aeronautical Engineering Faculty of Engineering at the University of Pretoria (UP), South Africa. He completed his Bachelor of Engineering in Mechanical Engineering, his Master of Engineering in Nuclear Engineering (Reactor thermal-fluid), and his PhD in Mechanical Engineering (thermal-fluid).His research includes mathematical modelling, thermal fluid behaviour and stability of nanofluids, improvement of heat transfer by nanofluids, convective multiphase flow, computational fluid dynamics, and Fluid Dynamics from Nanoscale to Universe scale. He established a Nanofluid Research Laboratory at UP in 2010, one of Africa's most active and productive nanofluid research laboratories. He is an innovative thinker and, based on fluid dynamics, constructal law, nature and patterns in nature, and cosmology data, he invented a new general and multidiscipline theory as the “Source and Sink Theory”. His general-multidiscipline theory has the potential to describe the early universe better than previous theories, and the link to the online article is https://dx.doi.org/10.22606/tp.2020.51001. He believes his theory is the case for the future. Professor Sharifpur has authored or co-authored more than 350 peer-reviewed articles published in accredited journals, chapter books and international conference proceedings. At UP, he has supervised more than 30 post-doctoral researchers, PhD and Master students. Professor Sharifpur has been the editor or guest editor for several journals in his field. He has been within the top 2% of highly cited researchers for 2020, 2021 and 2022. He is regularly invited as a keynote speaker at international conferences. He is on the scientific committees of several international conferences. He has received a C2 scientist rating by National Research Foundation (NRF) of South Africa in 2016.Professor Sharifpur recently co-edited a book for Elsevier entitled “ Nanofluid Applications for Advanced Thermal Solutions”. The link to the book is:https://www.elsevier.com/books/nanofluid-applications-for-advanced-thermal-solutions/sonawane/978-0-443-15239-9

Nanofluids, Preparation, Selection rules, Modeling as a one-phase cooling heat transfer fluid and thermal management for consumer electronics

A nanofluid is an engineered colloidal suspension of nanoparticles in a conventional heat transfer fluid called the base fluid. Nanofluids as new heat transfer fluids approved enhancement in heat transfer, which makes them a good candidate for different applications. Removing more heat with less amount of fluid means it is possible to design smaller cooling systems, which makes nanofluids a proper heat transfer fluid for electronic cooling. Research into convective nanofluids is one of the most attractive research areas in the field of heat transfer. Adding proper nanoparticles to a conventional heat transfer fluid will result in a higher thermal conductivity, which is an advantage for heat transfer. However, adding nanoparticles to a fluid will increase the viscosity, which is a negative point for pumping power. The most important point is to find the optimum volume fraction of the nanoparticles to provide the best enhancement. In this keynote, the preparation, selection rules, modeling with nanofluids and thermal management for consumer electronics will be discussed. The challenges of using nanofluids will be addressed as well.

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Prof. Jérôme Barrau

University of Lleida, Spain

Jérôme Barrau holds a doctorate in industrial engineering from the University of Lleida (UdL, Catalonia, Spain) and an industrial engineer Master from IUSTI (Marseille, France). With preliminary experience in the industry (1 patent for THOMSON MULTIMEDIA), he has been a university professor since 2004 at the UdL and has participated in 4 national and 3 European collaborative research projects in the field of thermal management systems and concentrated solar energy, where he stands out as IP of the UdL in the STREAMS H2020 project (Grant Agreement 688564) and coordinator of the Horizon Europe SolarX project (Grant Agreement 101084158). He is the author of more than 50 scientific publications, communications at conferences, co-inventor of 3 patents, director of 6 doctoral theses (one of them an industrial doctorate) and IP and co-founder of the spin-off Universal Smart Cooling (UniSCool).

Topic: Improving The Cooling Performance through Self-adaptive Components for Non-uniform and Time Dependent Heat Loads

Although current cooling solutions are mainly focused on high compactness and low thermal resistance, some works try to optimize the design of the cooling devices to achieve high temperature uniformities and low pumping power for given heat load distributions. However, most of the electronic applications present non-uniform and time-dependent heat load scenarios that can induce the appearance of hot-spots and lead existing systems to both oversized pumping powers for changing conditions and optimized junction temperature uniformities only for a given heat load distribution. To overcome these problems, we propose a system based on self-adaptive components acting as passive thermal actuators, being activated, without any external excitation, in function of their own temperature. Consequently, the system can tailor its internal geometry to time dependent and non-uniform heat flux distributions, optimizing the local heat transfer enhancement and the pressure drop to the instantaneous cooling needs. The impact of these cooling solutions on the temperature uniformity has been experimentally validated at microscale (25%) and mesoscale (80 %) and the pumping power reduction can reach up to 70%, depending on the heat load scenario.

Speech on 9th of October, State Room II, Thermal Dissipation Technology

Prof. Carlos Nieto de Castro

Universidade de Lisboa, Portugal

Carlos A. Nieto de Castro was born in Portugal in 1949. Full Professor at the Faculty of Sciences of the University of Lisbon since 1980, jubilated in 2019. Studied Chemical Engineering, and obtained his PhD in Engineering Sciences (Chemical Thermodynamics) from Instituto Superior Técnico, Portugal (1977). Received the Portuguese Stimulus to Excellence in Research Award, FCT-MCTES, Portugal (2005), the University of Lisbon Medal for distinguished service and has about 400 scientific publications including 38 books and chapters, one European patent and 550 conference presentations. He directed over 40 national and international funded projects, part of them involving industrial companies. Member of several international scientific boards and learning societies, he is an international evaluator under European, National, and International programs, associate editor of the Journal of Chemical and Engineering Data (ACS), editorial board member of several journals, IUPAC and International Association for Advanced Materials fellow. Prof. Carlos Nieto de Castro is one of world's most cited top scientists in Chemical Engineering/Physical Chemistry (top 2%), Stanford University Ranking, US, 2020, 2021, 2022. With more than 45 years dedicated to the research in thermodynamics and transport processes of fluids and materials, his actual scientific activity covers the field of molecular thermophysics and fluid technology, ionic liquids, molten salts, nanofluids, ionanofluids and nanosystems, including new heat and storage fluids with industrial impact in the area of energy and environment, and the use of ionic liquids as solvating and reaction media to synthesize and functionalize nanomaterials, for industrial and domestic applications.

Topic: Ionic Liquids and Nanomaterials as New and Sustainable Heat Transfer Fluids for Electronics Cooling

Ionic liquids (ILs) are salts in the liquid state at room temperature with some relevant properties, namely low vapor pressure over a wide temperature range, higher thermal conductivity than molecular fluids and molten salts, some of them being safe, non-toxic, biodegradable, with low viscosity and cost. Therefore, they are considered sustainable novel solvents in chemical technology, making them possible candidates for heat transfer applications. Although some of their thermophysical properties (density, heat capacity, thermal conductivity and viscosity) are very convenient for heat transfer applications, it has been shown that the dispersion of synthetic or natural nanomaterials in ionic liquids, the IoNanofluids, increase their efficiency in heat transfer and storage, making heat transfer units energetically more effective.The current address will give an overview of work in this area, focussing the possible applications of ionic liquids and IoNanofluids in the refrigeration area, namely their use in consumer electronics cooling. Aspects like nanofluid stability and nanomaterial impact on the environment will also be dealt, focussing on the sustainable development goals (SDGs) of United Nations.

Speech on 9th of October, State Room I, Graphics Technology

Prof. Nicolas P. Rougier

INRIA, France

Nicolas P. Rougier is a Inria senior researcher working in computational neuroscience at the Institute of Neurodegenerative Diseases (Bordeaux, France) where he's investigating decision making, learning and cognition. During the past two decades, Nicolas P. Rougier developed an expertise in scientific visualization and designed several open source libraries for fast, scalable and accurate rendering and taught a course on text rendering at SIGGRAPH.

Topic: Digital Typography

Typography is the art of arranging types to make written language legible, readable, and appealing when displayed. However, for the neophyte, typography is mostly apprehended as the juxtaposition of characters displayed on the screen while for the expert, typography means typeface, scripts, unicode, glyphs, shaping, weight, slant, etc. Typography is actually much more than the mere rendering of glyphs and involves many different concepts. This talk proposed to review some basic concepts in digital typography before diving into the different techniques to render text with the GPU.

Speech on 9th of October, State Room I, Graphics Technology

Mr. Jasper Bekkers

Traverse Research, Netherlands

Founder and CTO at Traverse Research, pioneer of Rust-based rendering engine, 15+ years of experience in the game industry, core developer of EA/Frostbite engine

Topic: Rust for Rendering Engine

Speech on 9th of October, State Room I, Graphics Technology

Mr. Dragos Tiselice

Rive, Romania

I'm a software engineer from Timișoara, Romania who is passionate about high-performance computing. My areas of expertise are computer graphics and compilers. I worked for a year at Presslabs, a website hosting startup, continued for a year as a PhD candidate at EPFL, then moved to Google where I stayed for four years working on an operating system called Fuchsia. I now work at Rive as a rendering and systems engineer. I'm active in the Rust community having developed two popular libraries: pest, a beginner-friendly parser generator, and later forma, a high-performance 2D vector renderer.

Topic: Fully Interactive Rive Boot Animation Drawn With A Custom Renderer

Boot environments are constrained in terms of processing power, API availability, memory space, and bandwidth. Animations within these environments have traditionally been implemented with these constraints in mind. As such, many popular open-source Android images use a series of compressed images (e.g. PNGs) decompressed directly to a framebuffer early in the boot sequence. While this falls well inside these constraints, it also leaves a lot to be desired: visibility of compression artefacts, lack of resolution and refresh-rate independence, severe limitations in terms of interactivity. To mitigate these shortcomings, we present a boot animation alternative that employs fully interactive Rive animations rendered directly to a compressed format with an efficient custom software renderer.

Speech on 9th of October, State Room I, Graphics Technology

Mr. Petr Kobalíček

Sneller, Czech

Petr Kobalíček is an independent software engineer and open-source enthusiast with 20 years of experience in C++ and assembly languages. He received a master's degree in Information Technology from TBU Zlín (Czech Republic) and went on to found the AsmJit and Blend2D projects. Currently, he works as an independent contractor specialized in designing and implementing high-performance software. He has experience in writing JIT compilers and using SIMD technology to maximize the performance of existing algorithms.

Topic: Blend2D - High Performance 2D Graphics Engine

Hardware-accelerated rendering is the current main research focus of 2D vector graphics. Consequently, traditional rendering engines that rely on software-based solutions have been stagnant in their pursuit for enhanced speed and competitiveness. Blend2D is an open-source high-performance 2D graphics engine which aims to excel at software-based 2D rendering with the help of advanced optimizations such as JIT pipeline generation and multi-threading. In this talk, Petr Kobalicek, the founder of the Blend2D project, will discuss some of those optimizations used by Blend2D and the future vision of the library.

Speech on 9th of October, State Room I, Graphics Technology

Dr. Kevin Rogovin

Procreate, USA/Finland

For over a decade, I have been smitten with using the GPU to render large heavy vector graphic scenes with performance. I aim to leverage my mathematics background and knowledge of GPU implementation details to implement such a renderer.

Topic: A Case Against Cross Platform Graphics System Library for Mobile Development

In this talk we will do an analysis for compositing and 2D drawing where strong vertical integration with the GPU offers a massive performance advantage.

Speech on 9th of October, State Room I, Graphics Technology

Mr. Sebastian Aaltonen

HypeHype, Finland

Sebastian Aaltonen has over 20 years of experience in graphics rendering technology. His main focus areas are engine architecture, low level rendering APIs, performance optimization and GPU compute. Sebastian was pioneering GPU-driven rendering development at Ubisoft and distance field ray-tracing at Second Order (Claybook). He was leading Unity's DOTS rendering team until he joined HypeHype to rebuild their mobile rendering technology.

Topic: HypeHype Mobile Rendering Architecture

Sebastian Aaltonen joined HypeHype one year ago with a mission to rebuild their mobile rendering architecture from scratch. The goal of the new rendering architecture is to reach state of the art performance, power efficiency and improve graphics programmer productivity. The new renderer is designed ground up for Vulkan, Metal and WebGPU. This presentation discusses the graphics API abstraction, performance-oriented architecture design and various optimizations.

Speech on 9th of October, State Room I, Graphics Technology

Mr. Andres Gomez

Igalia, Spain/Finland

Andres is a software engineer and partner at Igalia with 20+ years of experience working on Open Source development, including Linux-based Operating Systems, the GNOME platform, Web engines, and OpenGL drivers.Past experience includes work on the Maemo, MeeGo and SalfishOS projects, GNOME, WebKit (with a focus on the WebKitGTK port), and the Mesa3D graphics library, among several other projects. Andres currently works coordinating the efforts of Igalia's Kernel and Core team.

Topic: Driving Innovation in Embedded Systems with Open Source Technologies

Igalia is an Open Source consultancy with in-depth knowledge across the software stack and a broad selection of cutting-edge industries. This talk will present some of the projects and solutions Igalia has worked on for various embedded devices. It will also showcase some of the open source technologies created or contributed to by Igalia, such as WPE WebKit, Chromium, Servo, GStreamer, Mesa or the Linux Kernel. Finally, it will introduce Igalia's experience and vision on how open source technologies can enable innovation and performance in embedded systems.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Luca Mainardi

Politecnico di Milano, Italy

Luca Mainardi received the PhD in Biomedical Engineering in 1997 from Politecnico di Milano, where he is currently full Professor in Bioelectromagnetism and Biomedical Signal Processing. He is the Director of the Bachelor and Master Programme in Biomedical Engineering (the largest in Italy with 500 new entries/year) at Politecnico di Milano and the Co-Chair of the recently established Joint-Research Facility center between Politecnico di Milano and the Auxologico Hospital. Dr. Mainardi is fellow of the EAMBES and member of the Board of Computing in Cardiology. He is theme editor for track #1 on "Biomedical signal processing" of the IEEE-EMB conference and he was the Programme Co-Chair (and organizer) of the IEEE-EMB Conference in Milano on 2015 (>3000 attendees) and Berlin (2019). He is the past-Chair of the Technical Committee on "Biomedical Signal Processing" of the IEEE-EMB Society and he has been Chair of the International Medical Informatics Association (IMIA) WG7 on Biomedical Pattern Recognition. Dr. Mainardi was inserted in the list of the top 2 per cent of the most-cited scientists in his field by Stanford-University (2022). His research activity is in the field of biomedical signal and image processing, and biomedical system modelling, where he authored more than 170 peer reviewed papers on international journals and 18 book chapters. He raised >4M Euro funds in industrial and basic research grants in the area of Biomedical Signal and Image analysis. Among those, Prof. Mainardi was the Coordinator of the Marie-Curie EU project MY-ATRIA a "MultidisciplinarY training network for ATrial fibRillation monItoring, treatment and progression". He has served as reviewer/consultant for funding agencies in Europe including ESF, FCT and Horizon EU.

Topic: Integration of Smartwatch Data for novel Healthcare and Costumers applications

The talk explores the potentials provided by integration of signals and data gathered by Smartwatches in innovative domains, spanning from an enhanced arrhythmia and heart disease detection, cuff-less blood pressure measurements, health monitoring and disease prevention up to advanced emotion recognitions. Emphasis will be given to modern multi-parametric signal processing techniques combined with machine learning tools to improve quality of measurements and pave the way to novel applications.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Teemu Niiranen

Turku University Hospital and University of Turku, Finland

Teemu Niiranen, MD, PhD, is a physician-scientist and a clinical hypertension specialist. He is a Professor of Internal Medicine at the University of Turku and a Medical Specialist at the Finnish Institute for Health and Welfare. His research on hypertension and blood pressure measurement in large population cohorts has led to >200 publications that are repeatedly cited by the European, American, British, and Japanese clinical hypertension guidelines. He is a co-author of several European guidelines and position papers on hypertension and blood pressure monitoring. Dr. Niiranen has received young investigator awards from the American and Finnish Societies of Hypertension, and the American Heart Association. He is the past-president of the Finnish Hypertension Society and an editorial board member of Hypertension, the leading journal in hypertension research.

Topic: Blueprint for a Next-generation Blood Pressure Measurement Device

Hypertension (high blood pressure), the leading risk factor for global burden of disease, cannot be diagnosed, treated, or controlled without accurate blood pressure measurement methods. Blood pressure measurement methods have evolved drastically over the past 30 years with the introduction of automated out-of-office monitors. Nevertheless, there is still a need for ever-smaller, wearable blood pressure devices that are both accurate and unobtrusive for the patient. This presentation addresses

1) The recent developments in blood pressure measurement,
2) The optimal design and functions of a novel blood pressure monitor,
3) The up- and downsides of different blood pressure measurement techniques; and
4) How such devices should be validated.

Speech on 10th of October, Stateroom II, Health & Sport technology

Dr. Jordi Alastruey

King's College London, UK

Dr Jordi Alastruey is a Senior Lecturer of Biomedical Engineering at King's College London. He earned his PhD in Bioengineering from Imperial College London in 2006 and was a British Heart Foundation (BHF) Research Fellow from 2009 to 2013. His lab (www.haemod.com) specialises in cardiovascular (CV) haemodynamics. They investigate methods to assess CV function based on the analysis of pulse wave signals, such as blood pressure and photoplethysmography (PPG) waves. These signals can be measured in vivo using a variety of devices, including wearable sensors, and are influenced by the heart, vasculature, and respiratory and autonomic nervous systems, making them a rich source of information for assessing health. The lab develops (i) models for simulating pulse wave signals under physiological and pathophysiological conditions, (ii) methods for calibrating these models and understanding physical mechanisms underlying their results, and (iii) signal processing techniques to support clinical decision making. Further details on Dr Alastruey's research can be found here: http://haemod.uk/projects . Dr Alastruey's research has been primarily funded by the BHF, EPSRC, Innovate UK and industry.

Topic: Advancing Health Assessment through Synthetic Pulse Wave Data

This presentation aims to elucidate the role of synthetic pulse wave (PW) data in advancing technologies for the assessment of human health. It will start with an introduction to the simulation of PW signals, including blood pressure, blood flow, luminal area, and photoplethysmography waves, in systemic arteries using biophysical modelling. Then, it will focus on the creation of datasets that encompass simulated PW signals derived from thousands of virtual subjects, representative of samples of real subjects. The last part will demonstrate the utility of these datasets in fostering the development of novel PW analysis algorithms for wearables, extending beyond blood pressure estimation. The presentation will emphasise the importance of population-specific modelling, in contrast to patient-specific modelling, in the development of patient-specific pulse wave analysis algorithms for the evaluation of human health in daily life.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Lorenzo Chiari

University of Bologna, Italy

Full professor at the University of Bologna since 2016, conducts his research in the field of biomedical engineering. His research interests are directed, in particular, at Digital Health, focusing on technologies for home rehabilitation and in support of healthy and active aging, on the assessment of movement, balance and the risk of falling with wearable sensors, and digital biomarkers. At the University of Bologna, he led the Interdepartmental Center for Industrial Research on Health Sciences & Technologies (CIRI-SDV) and is a member of the research advisory board (GTA) on Cluster 1, Mission Cancer, and Innovative Health Initiative (IHI) of Horizon Europe. He is chair for Italy of the Italy-United States bilateral working group on "Innovative Technologies for Healthy Aging" and was the PI of 3 European projects (SENSACTION-AAL, FARSEEING, CuPiD) on topics about ICT for Ageing and Wellbeing and Personal Health System for remote management of disease, treatment, and rehabilitation. Since December 2022, he has been the President of the Board of the “DARE – Digital Lifelong Prevention” Foundation and the PI of the research project of the same name. DARE (2022-2026) is a flagship initiative funded by the Italian Ministry for University & Research to create and develop a connected and distributed knowledge community for digital preventive healthcare through research, innovation, and participation of multiple stakeholders. The initiative will produce, collect, and systematize multidisciplinary knowledge and solutions (technical, ethical-legal, and organizational) to affirm Italy as a leading country in digital prevention.

Topic: Digital Biomarkers For Health Promotion And Prevention: Extracting Actionable Insights From Real-world Data

In this talk, I will survey some of my past and ongoing activities focusing on digital biomarkers for health promotion and prevention, showing how physiological data collected with mobiles and wearables could contribute to risk assessment, early detection, and monitoring of a disease, with examples in the areas of neurodegenerative and age-related diseases.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Evgenii Zherebtsov

Aston University, UK

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Topic: Laser Doppler Spectrum Decomposition and Time-Frequency Analysis: from Fibre-optics to VCSEL-based Microvascular Disease Monitoring

In this talk, we explore a series of innovative developments in photonics-based laser Doppler flowmetry (LDF) techniques that range from sensor technology and signal processing approaches to practical applications in clinical diagnostics. In particular, we investigate the innovative integration of VCSEL-based dynamic light scattering sensors. These advancements hold substantial promise in enhancing our understanding of microvascular dynamics and improving the accuracy of diagnosis and monitoring in various medical contexts, particularly in the realm of vascular complications associated with Diabetes Mellitus type 2 and ageing.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Ilkka Korhonen

Tampere University, Finland

Professor Ilkka Korhonen is currently an Adjunct Professor in Faculty of Biomedicine and Health, Tampere University, Finland. He has more than 30 years of expertise in HealthTech, wearables, algorithms and sensing technology, research and translating research into products, partner relations, and business development. Korhonen's current research focuses on efforts to make the consumer a central user of health information and to use health tech to transform our behaviours to promote health and wellness. During his career, he has studied personal health systems, eHealth/mHealth, biosignal interpretation, health monitoring, and wearable health sensors, and decision making based on sensor data in critical care and anaesthesia. Earlier, he has been a Clinical Algorithm Lead at Meta, and CTO of Firstbeat, the developer of heart rate variability algorithms embedded in >50M consumer wearables by Garmin, Suunto, Huawei and others. He was also co-founder and CTO of PulseOn, one of the first companies to develop wrist worn heart rate monitors. He has over 200 international scientific publications, his H-index is 49 and he has ~10k citations to his work. He is a founding member of IEEE EMBS TC on Wearable Biomedical Sensors and Systems, member of IEEE EMBS TC for Biomedical and Health Informatics, and Senior Member in IEEE EMBS.

Topic: Towards Pervasive Health Management with Wearable Sensors – Where We Stand?

Health outcomes are largely determined by our behaviours, such as diet, physical activity, sleep, stress, smoking, substance abuse, medication adherence, and, in case of communicable diseases, to adherence to personal hygiene, use of face masks, and social distancing. Wearable and ambient sensors offer pervasive monitoring of physical health status and quantify health related behaviours. Progress in sensor technologies and algorithms has been tremendous during last decade, and in the near future, we will be able to seamlessly monitor most important elements of our physical health. However, the data and devices alone do not transform into better health outcomes, and physical health parameters represent only part of our overall health status. To change outcomes, we must affect the health behaviours which are affected by social, mental, contextual and physical factors, as well as intrinsic motivations, preferences, and biases. To affect behaviours, we need a holistic approach of health sensing, combining data from different sensors and over extended periods of time.

Speech on 10th of October, Stateroom II, Health & Sport technology

Dr. Esa Hynynen

Olympic sports Institute Finnish Institute of High Performance Sport, Finland

Esa Hynynen works as a specialist in sports physiology in Finnish Institute of High Performance Sport KIHU, Jyväskylä, Finland. He has been working in the area of sports physiology in different research and development projects but lately concentrated on giving scientific support for Finnish elite athletes to perform at their best. He graduated from the Department of Biology of Physical Activity in Faculty of Sport and Health Sciences in the University of Jyväskylä, and holds MSc and PhD degree on Sports Sciences. His research interest has concentrated on heart rate variability and its relation to stress of physical training and overtraining. In addition to lot's of work on heart rate variability analysis, he has been involved with spiroergometer measurements in fitness testing and he was also a member of The Finnish Society of Sport Sciences, Committee of Physiological Testing between years 2002-2010. While beginning his career in KIHU, he also had a part-time job during 1997-1999 as a regional coach for junior cross country skiers and during 2000-2004 as a coach for national "B-team" of junior cross country skiers in Finland.Lately, special environmental stress in Olympic Games in Tokyo 2020 challenged athletes' well-being and performance capacity and Hynynen helped the Olympic Team of Finland to prepare for the hot and humid environment with the latest scientific knowledge available. He was also working in the group preparing Olympic Team of Finland to the Beijing 2022, where the altitude and cold environment were putting extra challenge for competing athletes.

Topic: Scientific Support for Finnish National Cross-Country Skiing Team

In athletic training, which can be considered as a mainly physical stress model, the overload principle is widely used. The overload training principle is intended to disturb the homeostasis of the body through the physical stress of a training session (alarm reaction). During the subsequent recovery phase, the physical capacity is recovered, possibly to a higher level than before the training session (resistance or adaptation phase). This process needs coordination of various systems that are appropriate to counteract the threats to homeostasis. The autonomic nervous system, including both the parasympathetic and sympathetic pathways, is highly responsible for this regulation of homeostasis. Heart rate and heart rate variability values are considered to reflect autonomic modulation and can be easily measured in real-life situations.As levels of heart rate variability indices and their responses are highly individual, it is extremely important to build a large database of an athletes' own values. While building this kind of individual database, sources of stress should be also recorded. For international level athletes, the physiological training stress is commonly the most important stressor, but there can be others, too. When analyses are done from data collected during wakefulness, many different issues may have effects on autonomic modulation. Issues like the time of day can be standardized, but e.g. thoughts are more difficult to control. Therefore, cognitions may play a role in these recordings. When recording heart rate variability during nocturnal sleep, we have somewhat freedom of external disturbance, and are able to analyze the most important period of recovery, too.During rest, the parasympathetic activity is normally high and this is reflected in high values of heart rate variability indices. As a response to overload training, diminished values of heart rate variability are typically seen. After suitable rest or easier training, recovery to high values can be found. Responses to different stressors are dependent not only acutely on the power and duration of the stressor, but it is also possible that the stress effects are sustained or even cumulated for a longer period of time.In addition to monitoring athlete's stress and recovery regularly, physical capacity should be monitored a couple of times during training season. Laboratory exercise testing is commonly used to evaluate the physiological capacity and to prescribe individual exercise intensity zones of an endurance athlete. In cross country skiing, numerous different skiing techniques are used in training and differences exist especially between classic and skating styles. Furthermore, different lengths of races range from sprint races of a couple of minutes to long distance races of more than two hours in Olympic Games and in World Championships. In a separate series of long distance races the length of the race may be over four hours. Therefore, not only maximal oxygen uptake, but also factors like economy of skiing, lactate thresholds, and maximal speed play big role in the performance of a cross country skier. These different capacities are sport specific and therefore it is not recommended to do physical testing of cross-country skiers on cycle ergometer or running on treadmill, but preferring roller skiing testing on a large treadmill.

Speech on 10th of October, Stateroom II, Health & Sport technology

Prof. Lennart Scheys
KU Leuven Institute, Finland

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Topic: Physics-based Computational Modeling and Simulation for the Development of Health applications

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Speech on 10th of October, Stateroom I, Session I, System Security

Prof. Peter Pietzuch

Imperial College London, UK

Peter Pietzuch is a Professor of Distributed Systems at Imperial College London, where he leads the Large-scale Data & Systems (LSDS) group (https://lsds.doc.ic.ac.uk). His research work focuses on the design and engineering of scalable, reliable and secure data-intensive software systems, with a particular interest in performance, data and security issues. In addition, he is a Co-Director for Imperial's I-X initiative on AI, data and digital (https://ix.imperial.ac.uk). Recently, he has served as the Chair of the ACM SIGOPS European Chapter (EuroSys) and the Programme Committee Chair for ACM SoCC 2023 and IEEE ICDCS 2018. Before joining Imperial College London, he was a post-doctoral Fellow at Harvard University. He holds PhD and MA degrees from the University of Cambridge.

Topic: Improving Cloud Security with Hardware Capabilities

More and more data-intensive applications, e.g., micro-service architectures and machine learning workloads, move from on-premise deployments to the cloud. Traditional cloud security mechanisms focus on strict isolation, but these applications require the efficient yet secure sharing of data between components and services. In this talk, I will explore how we can use a new hardware security feature, memory capabilities, to design a cloud stack that bridges the tension between isolation and sharing. Memory capabilities constrain memory accesses, and they can be used to provide a VM-like isolation mechanism, CAP-VMs, that can share data more efficiently than containers. Capabilities can also increase memory efficiency by safely de-duplicating application components. I will discuss our experience in building a cloud stack using memory capabilities on the CHERI architecture, as implemented by Arm's Morello hardware.

Speech on 10th of October, Stateroom I, Session I, System Security

Prof. Pramod Bhatotia

TUM, Germany

Pramod Bhatotia is a Full Professor and Chair of Computer Science at the Technical University of Munich and the University of Edinburgh, UK. His profile is available here: https://dse.in.tum.de/bhatotia/

Topic: Trustworthy Accelerated Devices

Accelerated computing devices, such as GPUs, TPUs, and custom ASICs, have revolutionized various industries with their immense computational power. However, their accelerated nature introduces security challenges that cannot be ignored. This talk focuses on the imperative concept of "Trustworthy Accelerated Devices," exploring the critical need for balancing performance and security. We delve into the security threats accelerated devices face due to their parallelism and shared resources. Emphasizing trustworthiness, we discuss hardware and software strategies to mitigate these vulnerabilities. Real-world applications, from financial transactions to autonomous vehicles, showcase the practical impact of trustworthy acceleration. Looking ahead, we explore the evolving landscape of accelerated computing, emphasizing the importance of ongoing research in securing these devices while maintaining their exceptional performance. Join us to understand how trust can underpin the next generation of accelerated computing, enabling us to harness their transformative capabilities safely and effectively.

Speech on 10th of October, Stateroom I, Session I, System Security

Prof. Seppo Virtanen

University of Turku, Finland

Dr. Seppo Virtanen is Professor and head of the of Cyber Security Engineering research group at the Department of Computing, the University of Turku, Finland. He received his PhD [DSc(Tech)] in Communication Systems Engineering in 2004 from the University of Turku. In 2009, he was awarded the title of adjunct professor (dosentti) in Embedded Communication Systems. He is a Senior Member of the IEEE. He has supervised five PhD theses and more than 140 Master's theses to completion. He has taught more than 70 instances of 23 different university courses to engineering students as principal instructor. His current research interests are on cyber security in smart environments, secure network and communication technology and security technologies for IoT.

Topic: Security of Networked Systems - Current and Future Directions for Research

The talk will give an overview of current and forthcoming research in the security of networked systems field. How will autonomous system development and the application of artificial intelligence change the future of cyber security research?

Speech on 10th of October, Stateroom I, Session I, System Security

Myoung Jin Nam

King's Collage London, UK

Myoung Jin Nam is an expert in memory safety enforcement for security and system correctness. She is currently a research associate at King's College London, where she works on compartmentalization for Chrome. Prior to joining King's College London, she earned her Ph.D. from the University of Cambridge with her project focused on memory protection. She worked in South Korea, Singapore, Canada, Germany, and Finland, conducting projects with academia, industry, and governments in various domains, including heterogeneous systems, hardware synthesis, network traffic identification systems, and atomic power plants.

Topic: Tagged Pointer-Based Capability Model: Security and Performance Trade-offs and the Role of Software

Enforcing memory safety and system correctness can ensure security by eliminating vulnerabilities that attackers can exploit in the first place. However, high and unpredictable performance degradation remains a primary challenge. This section discusses the trade-offs between comprehensive memory protection and the cost to obtain it, identifies the desirable role of software, and proposes a new software-only tagged pointer-based capability system as a stand-alone solution and prototype for future hardware design.

Speech on 10th of October, Stateroom I, Session I, System Security

Dr. Julian Horsch

Fraunhofer AISEC, Germany

Dr. Julian Horsch is the deputy head of the Secure Operating Systems Department at Fraunhofer AISEC, a leading Germany-based institution in applied research for cybersecurity. In this role, he is responsible for overseeing a variety of projects and initiatives aimed at enhancing the security of operating systems and low-level software in general. He holds a Master's and a doctoral degree in Computer Science from the Technical University of Munich. His research interests include integrity protection mechanisms for ARM-based systems, compiler-based security of low-level software and fuzz testing.

Topic: Securing Linux-based RISC-V Devices with CHERI

Memory errors, facilitated by unsafe programming languages such as C and C++, remain a significant gateway for critical exploits in contemporary systems and devices, despite the issue's longstanding recognition. Several solutions have been proposed to combat this issue, ranging from the adoption of secure programming languages like Rust to the application of techniques that mitigate specific exploit strategies, such as Control-Flow Integrity (CFI). Additionally, there have been attempts to retrofit C/C++ programs with memory safety. However, while retrofitting appears to be an attractive solution due to the pervasiveness of significant C/C++ code bases, it often incurs prohibitive performance overheads when implemented purely in software. The CHERI processor extensions, developed by Cambridge University, offer a potential solution by delivering hardware functions that efficiently detect and prevent common memory errors. In a joint research project, Huawei's Helsinki System Security Lab and Fraunhofer AISEC have investigated the application of CHERI for RISC-V in securing Linux-based systems. This talk will initially cover the fundamentals of memory safety and the core principles and functionality of CHERI. Subsequently, we will delve into the challenges encountered and insights gained from our CHERI research project.

Speech on 10th of October, Stateroom I, Session I, System Security

Hugo Lefeuvre

The University of Manchester, UK

Hugo Lefeuvre is a PhD candidate at the University of Manchester, UK. He is a Microsoft PhD Fellow, a Debian Developer, and a Unikraft core developer. His research interests span OSes, compartmentalization, confidential computing, and more generally systems, security, virtualization, and networking.

Topic: FlexOS - Making OS Isolation Flexible

Operating Systems (OSes) have historically been classified according to their isolation properties: monolithic OSes, microkernels, single-address-space OSes, or unikernels. Decades of experience in research and industry showed that there is no silver bullet and that different use-cases might demand different approaches to optimize safety and performance. What if we tried to design an operating system able to be easily reconfigured into any of these points in the OS design space? What if the OS could be a microkernel, a unikernel, or a monolithic OS, at will, and using a wide range of hardware-and software-backed isolation mechanisms? In this talk, we will present FlexOS, the result of our recent research work in trying to answer this question. FlexOS is an OS allowing users to easily specialize the safety and isolation strategy of an OS at compilation/deployment time, instead of design time. Depending on the configuration, the same FlexOS code can mimic a microkernel with multiple address-spaces, a single-address-space OS with Intel MPK compartments, or many other OS isolation approaches. We have implemented a prototype of FlexOS on top of Unikraft, a popular library OS framework. FlexOS was previously published at ASPLOS'22, where it was awarded a Distinguished Artifact Award, and at HotOS'21. We will conclude the talk with perspectives gained on flexible isolation since the publication of FlexOS, and future research challenges.

Speech on 10th of October, Stateroom I, Session I, System Security

Paul Staat

Max Planck Institute for Security and Privacy Bochum, Germany

Paul Staat received the B.Sc. degree in electrical engineering and the M.Sc. degree in communication systems and networks from the University of Applied Sciences Cologne, Germany, in 2016 and 2018, respectively. He is currently working towards the Ph.D. degree at the Max Planck Institute for Security and Privacy in Bochum, Germany under supervision of Prof. Christof Paar. His research interests include physical-layer security, wireless sensing and communication, and tamper-resistant hardware.

Topic: IRShield: How to Counter Privacy Threats of Wireless Sensing

Today's ubiquitous wireless devices are attractive targets for passive eavesdroppers to launch reconnaissance attacks. Regardless of cryptographic measures, adversaries can overhear standard communication signals on the physical layer to obtain estimations of wireless propagation channels. These are known to contain information about the surrounding environment, which can be extracted using wireless sensing methods. In this way, adversaries may gain sensitive information which poses a major privacy threat. For instance, it is easily possible to infer human motion, allowing to remotely monitor premises of victims. In this talk, we first review wireless sensing and its privacy implications. We then introduce IRShield - a countermeasure against adversarial wireless sensing based on recent advances on intelligent reflecting surfaces. IRShield is designed as a plug-and-play privacy-preserving extension to existing wireless networks. We demonstrate that IRShield defeats a state-of-the-art human motion detection attack described in the literature.

Speech on 10th of October, State Room I, Session II, Cloud Security & AI

Prof. Valtteri Niemi

Helsinki University, Finland

Valtteri Niemi is a Professor of Computer Science in University of Helsinki and leads the Secure Systems research group. Earlier he has been a Professor of Mathematics in two other Finnish universities: University of Vaasa during 1993-97 and University of Turku during 2012-2015. Between these two academic positions Niemi served for 15 years in various roles at Nokia Research Center and was nominated as a Nokia Fellow in 2009. At Nokia, Dr. Niemi worked for wireless security, including cryptological aspects and privacy-enhancing technologies. He participated 3GPP SA3 (security) standardization group from its beginning and during 2003-2009 he was the chairman of the group. He has published more than 100 scientific articles and he is a co-author of 4 books and more than 35 patent families.

Topic: Secure location sharing protocol ???

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Speech on 10th of October, State Room I, Session II, Cloud Security & AI

Prof. Tomi Kinnunen

University of Eastern Finland, Finland

Tomi H. Kinnunen is full professor of speech technology at the University of Eastern Finland (UEF). He received his Ph.D. degree (computer science) from the University of Joensuu in 2005. From 2005 to 2007, he was with the Institute for Infocomm Research (I2R), Singapore. Since 2007, he has been with UEF. From 2010 to 2012, he was funded by a postdoctoral grant from the Academy of Finland. He has been a PI or co-PI in three other large Academy of Finland-funded projects and a partner in the H2020-funded OCTAVE project. He chaired the Odyssey: Speaker and Language Recognition workshop in 2014. From 2015 to 2018, he served as an Associate Editor for IEEE/ACM Trans. on Audio, Speech, and Language Processing and from 2016 to 2018 as a Subject Editor in Speech Communication. He is one of the technical program chairs (TPCs) of the upcoming Interspeech 2025 conference. In 2015 and 2016, he visited the National Institute of Informatics, Japan, for 6 months under a mobility grant from the Academy of Finland. He is one of the co-founders of the ASVspoof challenge, a nonprofit initiative that seeks to evaluate and improve the security of voice biometric solutions under spoofing attacks. His research interest include speaker and language recognition, speech anti-spoofing, speech feature extraction, and statistical evaluation metrics.

Topic: A Decade of Research in Speech Deepfakes and Anti-Spoofing: Lessons Learnt and Future Challenges

Deepfakes are ‘fake’ multimedia data generated using deep learning models, whereas spoofing attacks refer to approaches for deliberately misguiding biometric systems to increase their false acceptance rates. In this talk, I will focus exclusively on speech - the most important form of human communication. Thanks to decades of research in signal processing and machine learning, speech technology has also entered our daily lives. Automatic speaker verification (ASV), or voice biometrics, is a mature technology aimed at verifying a person’s identity using his or her voice, with applications ranging from call center security and forensics to smartphone login. Nonetheless, like other biometric modes, ASV is known to be vulnerable to spoofing through various attack vectors including replay, voice cloning, and voice conversion. Driven initially by the need to retain trustworthiness of voice biometrics, a new research community focused on developing countermeasures against spoofing attacks has recently emerged. An important facilitator has been availability of public, large-scale evaluation data, such as those available through the ASVspoof challenge series (www.asvspoof.org). Stemming from my experiences as a co-founder and co-organizer of the ASVspoof challenge series -- now on its fifth edition -- I provide a selective summary of lessons learnt through the past decade in the detection of speech spoofing attacks and deepfakes. I will highlight the trends and progress made, along with unsolved problems and possible directions for future research.

Speech on 10th of October, State Room I, Session II, Cloud Security & AI

Prof. Fahad Shahbaz Khan

Mohamed bin Zayed University of Artificial Intelligence, Abu Dhabi, UAE

Fahad Khan is currently Professor of computer vision at MBZUAI, United Arab Emirates. He also holds a faculty position at Computer Vision Laboratory, Linköping University, Sweden. He received the M.Sc. degree in Intelligent Systems Design from Chalmers University of Technology, Sweden and a Ph.D. degree in Computer Vision from Computer Vision Center Barcelona and Autonomous University of Barcelona, Spain. He has achieved top ranks on various international challenges (Visual Object Tracking VOT: 1st 2014 and 2018, 2nd 2015, 1st 2016; VOT-TIR: 1st 2015 and 2016; OpenCV Tracking: 1st 2015; 1st PASCAL VOC Segmentation and Action Recognition tasks 2010). He received the best paper award in the computer vision track at IEEE ICPR 2016. He has published over 100 reviewed conference papers, journal articles, and book contributions. His research interests include a wide range of topics within computer vision and machine learning. He serves as a regular senior program committee member for leading conferences such as, CVPR, ICCV and NeurIPS.

Topic: Towards Detailed Understanding of the Visual World

Machine perception that corresponds to the ability to understand the visual world based on the input from sensors, such as cameras is one of the central problems in Artificial Intelligence. To this end, recent years have witnessed tremendous progress in various visual perception tasks having real-world applications in e.g., robotics, autonomous driving and surveillance. In this talk, I will first present our recent results towards understanding state-of-the-art deep learning-based visual recognition models in terms of their robustness and generalizability. Next, I will present our results on learning visual recognition models with limited human supervision. Finally, I will discuss moving one step further from instance-level recognition to develop video-based conversation models that merges the representational abilities of a pretrained visual encoder and the generative powers of an LLM, capable of understanding and conversing about videos.

Speech on 10th of October, State Room I, Session II, Cloud Security & AI

Prof. David Camacho

Technical University of Madrid, Spain

David Camacho is Full Professor at Computer Systems Engineering Department of Universidad Politécnica de Madrid (UPM), he is the head of the Applied Intelligence and Data Analysis research group (AIDA: https://aida.etsisi.uam.es), the Director of the PhD program in Computer Science and Technologies of Smart Cities, and the Director of the Master program in Machine Learning and Big Data at UPM. He holds a Ph.D. in Computer Science from Universidad Carlos III de Madrid in 2001 with honors (best thesis award in Computer Science). He has published more than 300 journals, books, and conference papers. His research interests include Machine Learning (Clustering/Deep Learning), Computational Intelligence (Evolutionary Computation, Swarm Intelligence), Social Network Analysis, Fake News and Disinformation Analysis. He has participated/led more than 50 AI-based R&D projects (National and International: H2020, MCSA ITN-ETN, DG Justice, ISFP, NRF Korea), applied to real-world problems in areas as aeronautics, aerospace engineering, cybercrime/cyber intelligence, social networks applications, disinformation countering, or video games among others. He serves as Editor in Chief of Expert Systems from 2023 and sits on the Editorial Board of several journals including Information Fusion, IEEE Transactions on Emerging Topics in Computational Intelligence (IEEE TETCI), Human-centric Computing and Information Sciences (HCIS), and Cognitive Computation among others.

Topic: Unmasking Deception: Harnessing AI and Machine Learning in the Battle Against Disinformation

In our interconnected world, disinformation, fake news, and related phenomena have emerged as a formidable global challenge with far-reaching consequences for our societies and nations. This pervasive misinformation encompasses a wide spectrum of deceptive content, including fake news, hoaxes, rumors, and propaganda, among other forms. Its detrimental effects ripple through crucial domains such as the economy, politics, and public health. The emergence of movements like the anti-vaccine campaign and instances of external interference in electoral processes, not to mention more recent instances of climate-change denialism, underline the grave implications of the dissemination of false information. Recognizing the escalating urgency of this issue, this presentation offers a concise exploration of the role of Artificial Intelligence (AI) and Machine Learning techniques in the fight against disinformation. Notably, advanced techniques such as Deep Learning, Transformers, and Natural Language Processing have emerged as powerful tools in this endeavor. This talk will spotlight the latest findings and outcomes achieved by the Facter-check architecture, an AI-driven, multilingual solution that combines Deep Learning, specifically Transformers technology, and Social Network Analysis to effectively detect and combat disinformation. Key features and recent successes of this architecture will be showcased.

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Dirk Manteuffel

Executive Director, Institute of Microwave and Wireless Systems, Germany

Dirk Manteuffel was born in Issum, Germany, in 1970. He received the Dipl.-Ing. and Dr.-Ing. degrees in electrical engineering from the University of Duisburg–Essen, Germany, in 1998 and 2002, respectively. From 1998 to 2009, he was a Project Manager with IMST, Kamp-Lintfort, Germany. He was responsible for industrial antenna development and advanced projects in the field of antennas and electromagnetic (EM) modeling. From 2009 to 2016, he was a Full Professor of wireless communications with Christian-Albrechts-University, Kiel, Germany. Since June 2016, he has been a Full Professor and the Executive Director of the Institute of Microwave and Wireless Systems, Leibniz University Hannover, Germany. His research interests include electromagnetics, antenna integration, and EM modeling for mobile communications and biomedical applications. Dr. Manteuffel was the Director of the European Association on Antennas and Propagation from 2012 to 2015. He served on the Administrative Committee (AdCom) of IEEE Antennas and Propagation Society from 2013 to 2015 and was an Associate Editor of IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION from 2014 to 2022. Since 2009, he has been an Appointed Member of the Committee “Antennas” of the German VDI-ITG.

Topic: On-Body Antenna Modelling and Optimization

There is an increasing demand for wireless devices worn on the human body. Applications range from consumer electronics, fitness tracking, health monitoring and medical devices. Devices should be small and electronics, including antenna should be integrated. The human body, primarily consisting of water, is a harsh environment for antennas and propagation due to strong losses and detuning of the antenna. Therefore, there is a need for sophisticated on-body antenna design and optimization methods not to deteriorate user experience. However, conventional antenna design methods and metrics are for free-space communication. E.g. the gain pattern of an antenna relies on free-space spherical wave propagation and does not provide any useful information when the wave is partially guided on the surface of the body. Moreover, the famous Friis equation that allows for an easy separation of transmit antenna, propagation channel and receive antenna does not hold for a lossy propagation environment as there is no clear separation between antenna currents and currents induced and re-radiated from the conductive body tissue. As a consequence, on-body antenna design and optimization is usually either done based on misconception of free-space metrics or as a black-box optimization of the entire radio link that enables less insight in how a good antenna has to be designed as part of that radio system. The talk will start with an introduction to radio propagation fundamentals on the human body. Based thereon, an antenna de-embedding from the channel will be derived that allows to define on-body gain patterns. Those on-body patterns allow for intuitive insight into the on-body propagation and enables educated on-body antenna designs. Next, different measurement setups for on-body antennas will be presented and discussed. Finally, a design methodology based on spherical wave expansion will be introduced and its practicability for on-body antenna design and optimization will be discussed based on different practical examples.

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Miguel Ferrando Bataller

Universitat Politècnica de València, Spain

Miguel Ferrando Bataller (Life Senior Member IEEE) is a professor at the Universitat Politècnica de València (UPV) Spain, . He is a Telecommunications Engineer (1977) and Doctor of Engineering (1982), Universitat Politècnica de Catalunya, (UPC) Barcelona (Spain).He began his teaching career in 1977 as Assistant Professor, Lecturer and Associate Professor at the UPC, in 1990 he joined the UPV as full professor, for the implementation of the School of Telecommunications Engineering, as director (1991-96) and as Vice-Rector of the UPV for 8 years. He has set up the Electromagnetic Radiation Group, and the Antennas and Propagation Laboratory, with the direction of 23 doctoral theses and the direction of multiple research projects on electromagnetism, numerical methods, antenna design and new technologies applied to education. He has published more than 90 papers in journals and 350 in national and international conferences and congresses. His h-index in Google Scholar is 33, and he has more than 5000 citations of his papers.His contributions in the design of UWB antennas, as well as in Characteristic Modes Theory, stand out. His contributions in computational techniques also stand out. He participated in the European Antenna Center of Excellence project, which launched the European Conference on Antennas and Propagation, the European School of Antennas and the European Association of Antennas and Propagation.

Topic: Small Antennas and Circularly Polarized (CP) Antennas

The lecture will cover fundamental small antenna types and miniaturization techniques, while also exploring theoretical limits to efficiency. The presentation will illustrate that when antennas are positioned on a platform, their radiation characteristics are affected by induced currents in the structure. This effect strongly depends on the antenna's location within the ground plane. We will introduce Characteristic Mode Theory as a tool for analyzing the resonances of these structures, which helps in identifying the optimal feeds required to achieve specific modes. Additionally, we will discuss how to combine radiation modes effectively to achieve circular polarization.

Speech on 11th of October, State Room II, Antenna & Filter

Dr. Gareth A. Conway

Queen's University of Belfast Institute of Electronics, Computing and Information Technology (ECIT)Centre for Wireless Innovation (CWI), Northern Ireland, UK

Dr. Conway has been producing internationally leading research in the area of Antennas and Propagation for over 18 years. He is an associate professor/ senior lecturer in wireless communications at Centre of Wireless Innovation, Queens University Belfast, Ireland. Gareth's research has won national and global awards, with high quality publications in the top academic journals, focusing on human body-centric wireless communication applications. Gareth combines technical knowledge with strong leadership skills and a commercial awareness, born from commercially funded research with close industrial links and partners. He is the co-founder and CEO of AntennaWare Ltd, a QUB spin-out formed in 2021.

Topic: Overcoming the Human Body in our Wireless Solutions

The human body presents a grand challenge for our body-centric wireless technology, with complexities, that mean that the wireless performance for devices in close proximity to tissue are difficult to characterise and ensure robust and reliable operation on every person, in every application use case. The human body can cause high signal absorption, poor radiation efficiency, complex impedance detuning, which are all dependant on the localised tissue morphology of the host and can vary from person to person. Furthermore, the human body is responsible for limited wireless coverage and connectivity. This is more problematic when there is no direct line of sight between the wearable device and the receiver as the body tissue absorbs the bulk of the power radiating from a wireless wearable device, severely reducing coverage, known as body blocking. Ultimately the end result is uncertainty in the system and poor wireless connectivity. These challenges get greater as the world moves up in frequency. In this talk we will explore the antenna and propagation challenges in close proximity to lossy structures, and the techniques and best antenna solutions to overcome the human body.

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Sergei Tretyakov

Aalto University, Finlad

Sergei A. Tretyakov received the Dipl. Engineer-Physicist, the Candidate of Sciences (PhD), and the Doctor of Sciences degrees (all in radiophysics) from the St. Petersburg State Technical University (Russia), in 1980, 1987, and 1995, respectively. From 1980 to 2000 he was with the Radiophysics Department of the St. Petersburg State Technical University. Presently, he is professor of radio science at the Department of Electronics and, Nanoengineering Aalto University, Finland. His main scientific interests are electromagnetic field theory, complex media electromagnetics, metamaterials, and microwave engineering. He has authored or co-authored six research monographs and more than 350 journal papers. Prof. Tretyakov served as President of the Virtual Institute for Artificial Electromagnetic Materials and Metamaterials ("Metamorphose VI"), as General Chair, International Congress Series on Advanced Electromagnetic Materials in Microwaves and Optics (Metamaterials), from 2007 to 2013, and as Chairman of the St. Petersburg IEEE ED/MTT/AP Chapter from 1995 to 1998.

Topic: Advanced Metasurfaces for Antenna Applications

In this talk I will review some recent results in the theory and design of advanced metasurfaces for control of electromagnetic radiation. In particular, we will discuss how metasurfaces as subwavelength-structured arrays can be used as all-angle scanning reflectarrays or all-angle scanning leaky wave antennas with perfect aperture efficiency. Furthermore, we will show how time-space modulated metasurfaces can realize reconfigurable nonreciprocal devices for waves and how time modulations of surface reactance of a boundary can amplify or temporarily "freeze" surface waves.

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Ausrine Bartasyte

University of Franche-Comté Deputy Director of FEMTO-ST Institute, France

Dr. A. Bartasyte is a full professor at FEMTO-ST Institute / University of Franche-Comté (UFC) since 2019 and a Junior Chair for Innovation at Institut Universitaire de France (IUF) since 2022. She was an associate professor (MCF) at IJL / University of Lorraine and chair of excellence of Labex ACTION at FEMTO-ST/UFC. She did PhD at LMGP/Grenoble INP (2008, award of the best PhD thesis), postdoctoral research at Oxford University on LN-LT solution single crystal growth/treatment, sabbatical leave to Harvard University on the films for photonic applications. She has an experience of 20 years in deposition of epitaxial multifunctional oxides and their heterostructures (superconductors, mixed conductors, high-k dielectrics and ferroelectrics) by means of liquid injection MOCVD and RF sputtering. Now, her research is focused on advanced engineering of LiNb(Ta)O3 thin films/single crystals for acoustic, energy harvesting, and optical applications. She presented 27 invited presentations & 10 invited seminars and is a co-author of over 70 scientific articles and 7 patents. She is a coordinator of several French national projects, H2020 ITN-ENHANCE and several industrial and maturation projects (TDK-EPCOS, Annealsys, WIKA). At present, she supervises 5 PhD students (10 supervised PhD thesis defended). She is a deputy director (president of scientific committee) of FEMTO-ST institute, vice president French national project selection committee, a member of committee of national network CMDO+, International Ultrasonics Symposium & conference MCARE, international advisory board of CIMTEC, etc.

Topic: Growth of Alkaline Films for High-frequency BAW and SAW devices

The next generations of Radio-Frequency (RF) wide-band filters or frequency-agile filters are urgently needed for the development of 5G infrastructures/networks/communications. Today, LiNbO3 and LiTaO3 single crystals are key materials in electro-optics and RF acoustic filters. This motivates further development of acoustic wave devices based on high electromechanical coupling LiNbO3 thin films, adapted to the above-mentioned RF applications. The challenges and the achievements in the growth of LiNbO3 films and their integration with Si technology to develop disruptive acoustic devices will be discussed in detail. The deposition techniques enabling the control of film composition/ non-stoichiometry of volatile alkali metal oxides and the methods of compositional analysis will be presented. A particular effort was done to achieve the epitaxial growth of films with controlled single orientation and nearly stoichiometric Li2O composition as well as to texture these films with highly-electromechanically-coupled orientations on BAW heterostructures [1, 2]. We have demonstrated acoustical performances compatible with filter applications for SAW and BAW devices, based on grown LiNbO3 films, operating at frequencies of 5-7 GHz [3]. Future prospects of potential applications and the expected performances of LiNbO3 and other alkaline niobate thin film acoustic devices are presented and discussed as well.c

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Oliver Ambacher

Albert-Ludwigs-University Institute for Sustainable Systems Engineering (INATECH)
Gips-Schüle Chair for Power Electronics, Germany

Oliver Ambacher received his diploma and doctor of natural sciences at the Ludwig-Maximilians and the Technical University of Munich with distinction in 1989 and 1993. In 1993 he got a position as a research assistant at the Walter Schottky Institute at the Technical University of Munich, where he dealt with the growth of gallium nitride and its alloys with the help of molecular beam epitaxy and chemical vapor deposition. He was significantly involved in the implementation of the first ultra violet light detectors, surface acoustic wave components, microwave amplifiers and sensors as well as in the research of polarization-induced effects in GaN-based hetero- and quantum structures. In 1998/99 he was offered the Feodor Lynen grant from the Alexander von Humboldt Foundation at Cornell University (USA) to deepen his work in the field of AlGaN/GaN transistors for high-frequency power amplifiers. Following his habilitation in experimental physics in 2000 and his promotion to senior assistant in 2001, he was appointed professor for nanotechnology at the Technical University of Ilmenau a year later. In 2002 he was elected director of the Institute for Solid State Electronics and two years later he was appointed director of the Center for Micro and Nanotechnologies. Since October 2007, Oliver Ambacher has been a professor at the Albert-Ludwigs-University in Freiburg and head of the Fraunhofer Institute for Applied Solid State Physics until 2021. He acquired a fundamental understanding of polarization-induced effects during a research stay as a young Humboldt fellow in Professor Les Eastman's group at Cornell University (1998-1999). In recent years Oliver Ambacher and his working group designed and demonstrated outstanding, integrated, broadband, low-noise amplifier for applications in cellular base stations for mobile communication. Due to its technical performance, this low-noise amplifier enables mobile communication with the help of various mobile radio standards in our wireless networks, such as 5G, LTE or WLAN. The work resulted in more than 650 journal contributions, about 300 conference and workshop proceedings, 7 books and book chapter and 8 patents.In 2015 he received the Karl-Heinz-Beckurts-Prize for his contributions to the development of highly efficient power amplifiers based on GaN for the latest generation of mobile phone base stations. In 2018 he was awarded an honorary professorship for power electronics by the Gips-Schüle-Foundation. In 2021 he was awarded the Rudolph-Jäckel-Prize for the development of energy-efficient power electronics. In 2022 he received the Lester F. Eastman Award of the IEEE Electron Devices Society.

Topic: Advancements in piezoelectric materials for high-frequency acoustic filters

Research into the material properties of GaxAl1-xN, ScxAl1-xN, and YbxAl1-xN are focused on layers with wurtzite crystal structure, which are particularly well suited for the development of novel electronic and piezo-acoustic devices due to their large band gap, high stiffness, and outstanding piezoelectric as well as ferroelectric properties.1 - 3 The piezoelectric coefficient e_33 from wurtzite AlN (wz-AlN), which is particularly interesting for high-frequency acoustic wave filters4, can be increased up to 150% by alloying AlN with ScN or YbN.5, 6 In addition, wz-ScxAl1-xN and wz-YbxAl1-xN layers (0.1≤x≤0.4) show ferroelectric properties and large remanent polarizations up to very high temperatures, which is of particular interest for memory devices.7 Significantly the ferroelectric effect enriches the dimension of polarization engineering in group-III-nitride-based heterostructures and provides opportunities for the integration of novel functionalities into electronic and piezo acoustic devices. To use the outstanding polarization properties for the realization of novel components or to optimize existing technologies, both a good understanding of the piezoelectric, spontaneous, and ferroelectric polarization and extensive knowledge of the structural, elastic, and thermodynamic properties of hexagonal GaN, ScN, YbN and AlN crystals as well as their ternary alloys, spanning the entire range of compositions, is required. For these reasons, we provide basic structural properties like the lattice parameters, average bond lengths and bond angles of hexagonal crystals, calculated from experimental data and density functional theory simulations. Based on this knowledge we discuss the elastic properties like Young's modulus, shear modulus, and compressibility depending on the crystals alloy and the direction of applied uniaxial strains. These material properties are used to calculate physical properties that are particularly relevant for piezo-acoustic filters, such as the sound velocities and coupling coefficients, in order to work out possible advantages of the novel nitride alloys compared to AlN.

Speech on 11th of October, State Room II, Antenna & Filter

Dr. Pedro de Paco & Dr. Jordi Verdu

UAB, Spain

Pedro de Paco (M'18-SM20) was born in Badalona, Spain. He received M.S. degree in Telecommunication Engineering in 1997 and a Ph.D. degree (Cum Laude) in 2003 from the Universitat Politècnica de Catalunya (UPC).In 1998, he joined the Electromagnetic and Photonics Engineering Group (EEF), signal theory and communications department (TSC-UPC) with a grant from the Institut d'Estudis Espacials de Catalunya (IEEC) in a joint activity related with the European scientific space mission Planck. He was member of the LFI-Radiometer working group and the Planck Consortium. During his PhD and UPC stage participated in several national and international research projects mostly related to microwave and millimeter-wave circuits and systems applied to design and testing of remote sensing instruments and front-end point-to-multipoint broad-band communication system. From 2004 and 2023 he has been Associate Professor and Full Professor respectively at the Universitat Autònoma de Barcelona where he teaches applied electromagnetics and microwave engineering courses. Awarded 3 times with merits in research and recognized with merits in University training by l'Agència de Qualitat, and awarded with Advanced Research by Generalitat Catalunya. He has advised 8 PhD students. From 2010-2013 he was deputy director and member of the Executive Board in the Telecommunication and System Engineering Department at UAB. During 2018-2019 he was a Visiting Researcher with the Microwave and RF Research Group, Colorado University-Boulder (US). He has been appointed as technical expert for Telecommunications Equipment by National Agency of Accreditation. He is member of MTT-6 RF MEMS and Microwave Acoustics Committee, reviewer for IEEE Transactions on Microwave Theory and Techniques, IEEE Microwave and Wireless Components Letters. He serves as a member of the Technical Review Board for the European Microwave Conference. His main research interests include Microwave filter synthesis and Microwave Acoustics filter synthesis and design, as well as Microwave and Radar systems and devices.

Jordi Verdú (M'18-SM20) received M.S. degree in Telecommunication Engineering in 2006 and a Ph.D. degree (Cum Laude) in 2010 from the Universitat Autònoma de Barcelona (UAB) awarded with the department best thesis prize. From 2006 to 2010 he was a member of the Antenna and Microwave Systems (AMS). In 2010 he joined the RF System Group at the European Spallation Source in Bilbao (ESS-B) where he was group coordinator. In 2011-2012 he was at the École Polytechnique Fédérale de Lausanne through a Marie Curie grant. In 2013 he joined the Theory Signal Communication group at Universitat Politècnica de Catalunya. Currently, he is an Associate Professor at the Universitat Autònoma de Barcelona where he teaches microwave engineering courses. He is a member of the MTT-6 MEMS and Microwave Acoustics Technical Committee, and reviewer of several transactions and letters of the IEEE. He has participated in several national and international projects mostly related to the design of Acoustic Wave Filters. His current research interest includes the design of microwave devices and linear modelling, but also the design of active devices for Space applications.

Speech on 11th of October, State Room II, Antenna & Filter

Dr. Pedro de Paco & Dr. Jordi Verdu

UAB, Spain

Topic: Acoustic Wave Technological Feasibility by Filter Synthesis methodologies.

With a spectrum more and more overcrowded, the design of filtering modules is becoming a challenging task. The major reasons are stringent transmission response and a very restrictive AW technology. The talk presents a methodology that provides a systematic synthesis procedure for designing, analytically in a single shot, a ladder filters but also multiplexers based on acoustic wave resonators. This procedure is time efficient, precise in the outcomes, and provides a deep understanding of orthogonal interactions between technology constraints and device performance. bWe also will show how through the understanding of the input phase role it is possible breaking down the current paradigm that dictates ladder topology. Our proposal breaks part of the rigidity of the AW ladder and allows responses with improved rejection/selectivity by controlling the input and output reflection phase as well considering technologically feasible solutions based on reduced Chebyshev responses.The complexity of the requirements in advanced 5G and forthcoming scenarios has a direct impact in the design of acoustic wave filters. Latest developments have pushed acoustic technology to an unprecedented situation that requires facing the incoming challenges from different perspectives. Taking this into account, the talk aims to present the latest developments related to synthesis methodologies considering the use of acoustic wave resonators.

Speech on 11th of October, State Room II, Antenna & Filter

Prof. Giuseppe Macchiarella

Fellow IEEE Politecnico di Milano, Italy

Giuseppe Macchiarella is a retired Professor of Microwave Engineering (he was with the Department of Electronic and Information, Polytechnic of Milan, Italy, until 2022). His research activity has covered several areas of microwave engineering: microwave acoustics (SAW devices), radio wave propagation, numerical methods for electromagnetic, power amplifiers, linearization techniques, passive devices. He has been Scientific Coordinator of PoliEri, a Research Laboratory on monolithic microwave integrated circuit (MMIC) jointly supported by Polytechnic of Milan and Ericsson Company. Currently, his activities are mainly focused on the development of new techniques for the synthesis of microwave filters and multiplexers.Prof. Macchiarella is author or co-author of more than 200 papers on journals and conferences proceedings. He has been responsible of several contracts and collaborations with various companies operating in the microwave industry. He has been Chair of IEEE Technical Committee MTT-5 (Filters). Since January 2015 Giuseppe Macchiarella is Fellow of IEEE.

Topic: Latest synthesis techniques for microwave filters used in advanced communication systems

The evolution of the communication technologies in the recent years has required more and more performing filtering subsystems. In particular, the very strict requirements in term of selectivity, passband losses and compactness have required new and more effective synthesis solutions. The aim of this talk is to introduce the most recent synthesis solutions proposed in the literature for microwave filters, which exploit new approximation functions characterized by complex reflection zeros (as an alternative to the imaginary reflection zeros obtained with the classical Chebycheff characteristic). These new approximation functions allow for the synthesis of very compact filters with several convenient features. For example, it is possible to realize filters with inline topology which have up to four transmission zeros in the response. Filters with all positive couplings are also possible, regardless the position of the transmission zeros (below or above the passband). The presentation will illustrate the synthesis techniques developed for some types of filters recently appeared in the literature (i.e., Path, Extracted Zeros, Strongly Coupled Quartet), which exploit the new approximation functions. Example of synthesis and practical implementation will be shown for each considered filter class. Comments on the possible use of the novel synthesis techniques in acoustic wave filters will terminate the presentationband). The presentation will illustrate the synthesis techniques developed for some types of filters recently appeared in the literature (i.e., Path, Extracted Zeros, Strongly Coupled Quartet), which exploit the new approximation functions. Example of synthesis and practical implementation will be shown for each considered filter class. Comments on the possible use of the novel synthesis techniques in acoustic wave filters will terminate the presentationsynthesis techniques developed for some types of filters recently appeared in the literature (i.e., Path, Extracted Zeros, Strongly Coupled Quartet), which exploit the new approximation functions. Example of synthesis and practical implementation will be shown for each considered filter class. Comments on the possible use of the novel synthesis techniques in acoustic wave filters will terminate the presentation.

Speech on 11th of October, State Room I, Audio

Prof. Jesper Rindom Jensen

Aalborg University, Denmark

Jesper Rindom Jensen was born in Ringkøbing, Denmark, in August 1984. He received his M.Sc. degree cum laude from Aalborg University in Denmark in 2009 and his Ph.D. degree from the same university in 2012. Currently, he serves as an Associate Professor at the Department of Electronic Systems at Aalborg University in Denmark. He is also the head of the research group, Audio Analysis Lab, since 2023, and has been a member since its establishment in 2012. In addition to his work at Aalborg University, he has also been a Visiting Researcher at the University of Quebec, INRS EMT, in Montreal, Quebec, Canada, the Friedrich Alexander Universität Erlangen Nürnberg in Erlangen, Germany, and the University of Surrey, UK.

Dr. Jensen's research interests revolve around signal processing theory and methods, particularly in the areas of robot and drone audition, and acoustic arrays. His specific research focuses include enhancement, separation, localization, tracking, parameter estimation, signal analysis, and modeling. He has an extensive publication record of over 990 papers on these topics in top-tier, peer-reviewed conference proceedings and journals. Additionally, he is the co-author of two books titled "Speech Enhancement – A Signal Subspace Perspective" and "Signal Enhancement with Variable Span Linear Filters."

Dr. Jensen has received numerous accolades, including a highly competitive postdoc grant from the Danish Independent Research Council and selection as an AAU Talent at Aalborg University. He has also been awarded several travel grants from private foundations. Furthermore, he actively contributes to the field as an Associate Editor of the EURASIP Journal on Audio, Speech, and Music Processing and as a member of various technical committees including the IEEE Audio and Acoustic Signal Processing Technical Committee and the EURASIP Acoustic, Speech, and Music Signal Processing Technical Committee. He is also a Member of the IEEE.

Topic: Controllable Speech Enhancement with Meta Learning for Optimal Filters

Enhancement of noisy speech is a key problem in many audio applications, including digital meeting technologies. In recent years, remarkable advances have been made in speech enhancement via the advent of artificial intelligence-based solutions. However, the most prominent approaches are operating in a blackbox manner, by taking noisy speech as input and providing cleaned speech at the output, and it is hardly understood what is happening inside of such enhancement methods. This raises a number of important concerns, such as “In which conditions can we expect the speech to be successfully enhanced?” “How can we ensure that the speech is not altered or degraded in the process? and “How do we further improve the speech enhancement technology?”To take a step towards being able to answer some of these questions, this talk will give a brief overview of state-of-the-art optimal filtering techniques for speech enhancement, and how machine learning can be used in combination with these via extraction of metainformation. More specifically, recent deep-learning-based methods to estimate the probability of speech presence in the different parts of an audio signal will be presented. Such probabilities enable the extraction of important information that can be used for optimal filtering-based speech enhancement when noise and speech are simultaneously present. In this way, the strengths of AI-based and traditional speech enhancement methods may be blended, allowing us to quantify and control key tradeoffs in the context of speech enhancement, such as speech distortion and noise reduction capabilities, which is currently not possible in most the recent t deep learning based approaches.

Speech on 11th of October, State Room I, Audio

Prof. Lorenzo Picinali

Imperial College London, UK

I am a Reader at Imperial College London, where I lead the Audio Experience Design team. My research focuses on spatial acoustics and immersive audio, looking at perceptual and computational matters, as well as at real life applications. More information about the work of my team can be found in the AXD (https://www.axdesign.co.uk/) and SONICOM (https://www.sonicom.eu) websites. I have also been active in the field of eco-acoustic monitoring, designing autonomous recorders and using audio to better understand the impact humans have on remote ecosystems (http://acoustics.safeproject.net/).

Topic: Latest Research and Future Perspectives in Immersive Audio over Headphones

The vast majority of the scientists involved in research in spatial acoustics and immersive audio need to deal, sooner or later, with human perception. This can be done in various ways, for example carrying out behavioural tests, or using computational models that aim at replicating human behaviour, or again relying on perceptually-informed metrics when doing numerical analysis. And one of the questions faced more often is “Does this matter? If so, to which extent?”In this presentation I will try to give a rapid overview of the work we are doing in the Audio Experience Design team at Imperial College London, aiming at addressing different facets of that same question. For example, when rendering reverberation for binaural playback, should we employ a ray-tracing algorithm based on a very accurate geometrical reconstruction of the space, or could it be enough to use a simplified algorithm simulating a simple shoebox room? And can this be generalised between different interactions (e.g. AR, VR, etc.), different scenarios and tasks (e.g. speech, music, remote communication, etc.), different contents, and so on? If we look more specifically at the personalisation of the filters we use for the spatialisation (Head Related Transfer Functions - HRTFs), do we need to measure them acoustically for every individual we involve, or could we use other methods? For example selecting a best-fitting one from a subset (if so, how would we do that?); or using the image of the head and ears to create a 3D model, and generate the HRTF from this; or again starting from very few acoustic measurements of HRTFs (e.g. 3-4 positions), and upsample them with the help of AI (more specifically, Generative Adversarial Networks or autoencoders). Finally, in addition to potentially affecting our localisation accuracy and the perceived realism of the rendered simulation, could any of these choices affect our ability to understand speech in simulated noisy situations, for example in an online meeting with several people talking at the same time?There are so many variables we are aware of but, ultimately, we don’t know what really matters from a perceptual point of view. And we know even less about how these options could condition more complex aspects of perception and cognition, for example the way we communicate and interact in a virtual environment. If I simulate my voice as being closer to the person I’m talking to, would I be more successful in engaging in an intimate conversation?

Speech on 11th of October, State Room I, Audio

Ph.D Student Haohe Liu

University of Surrey, UK

Haohe Liu is a PhD Student at the Centre for Vision Speech and Signal Processing, University of Surrey. His research is dedicated to the development of audio AI technology aimed at enhancing communication and inspiring creativity. Haohe's commitment to the open-source community is evident through his GitHub contributions, which have garnered over 5,000 stars. His open-sourced projects cover a wide spectrum of topics, including audio source separation, audio quality enhancement, audio recognition, and audio generation. Collectively, the models he has developed and published have been downloaded more than 100,000 times. As the primary contributor, he has spearheaded remarkable projects such as VoiceFixer, AudioLDM, and NaturalSpeech.

Topic: Natural Language Guided Audio Generation: Technologies and Applications

This presentation delves into the latest advancements and practical applications of natural language-based audio generation. Our speaker will explore the technology on the creation of lifelike music, sound effects, and speech. The talk will spotlight its diverse applications in the fields of media production, music industry, gaming industry, and virtual assistants. Furthermore, we will examine the seamless integration of audio generation models with large language models such as ChatGPT. Join us in uncovering the potential of automated audio content creation and its transformative impact on consumer devices, services, and our interaction with technology.

Speech on 11th of October, State Room I, Audio

Ph.D Student Wenyi Yan

Brunel University London, UK

Wenyi Yan is a Ph.D. candidate specializing in signal processing at Brunel University London, supervised by Dr. Lu Gan and Dr. Shaoqing Hu. Before embarking on her Ph.D., Wenyi was a member of the Intelligent Speech and Audio Research Lab (ISARL). This lab is a collaborative initiative between Brunel University and the Chongqing University of Posts and Telecommunications (CQUPT). The team members at ISARL have an impressive track record with victories in numerous DCASE competitions. Moreover, they have forged extensive collaborations with the industry, particularly in speech signal processing and intelligent audio analysis. Wenyi's current research is centered on addressing the dynamic range limitations in imaging and signal processing. Her innovative approach employs the use of MCM-ADCs. Alongside this, she is also delving into potential applications that span from technical communication systems to the realm of consumer electronics.

Topic: Pushing Audio Boundaries: Explorations and Innovations with Multi-Channel Modulo ADC Technology

As the digital age continues its rapid evolution, consumer expectations for immersive and detailed audio experiences are reaching new heights. This is particularly evident with the advent of High Dynamic Range (HDR) audio—a technology that has highlighted the limitations of traditional ADCs in capturing wide dynamic ranges. To address these challenges, this presentation introduces an innovative solution: Multi-Channel Modulo Analog-to-Digital Converters (MCM-ADCs). Our talk will begin by outlining the unique advantages of MCM-ADCs, which include their exceptional ability to handle a wide dynamic range and minimize noise and distortion, all while operating at a low hardware cost. Looking ahead, the transformative capabilities of MCM-ADCs promise to revolutionize a wide array of applications, from enhancing natural listening experiences in headphones to enabling high-fidelity audio capture in smart devices.

Speech on 11th of October, State Room I, Audio

Dr. Stefan Liebich

Company: Elevear GmbH, Germany

Stefan is the CEO and Co-Founder of Elevear, an experienced presenter on technical conferences, renowned for pioneering research on active occlusion and noise cancellation algorithms, for which he received his Dr.-Ing. -degree with summa cum laude and the Borchers Medal.[long]Stefan is one of the co-founders and the CEO of Elevear. He is one of the driving forces behind the company, which is working on algorithms for active occlusion cancelling, active noise cancelling, transparency features with idle noise reduction and spatial audio algorithms. He co-authored over 15 scientific publications, and spoke at various events including the ICASSP, EUSIPCO and the IEEE distinguished lecture series. He invented several technical innovations both during his time at RWTH and at Elevear.Before founding the company, he received his Dr.-Ing. Degree from RWTH Aachen University in Germany in 2021 under the supervision of Prof. Dr.-Ing. Peter Vary. He received various honors, including the Otto-Junker Award and the Springorum Medal for his studies as well as the Borchers Medal for his PhD after finishing with summa-cum laude. He a is a member of the Institute of Electrical and Electronics Engineers (IEEE), a global authority in advancing technological innovation, as well as the German association of electrical engineers, the VDE, solidifying his commitment to the advancement of electrical engineering in his home country.At the heart of Stefan's pursuits lie his profound research interests and motivation to bring together the right people. The contributions of his team and him have significantly impacted the realms of own voice and ambient sound perception, as well as noise cancelling particularly concerning ear-worn devices.

Topic: Shaping the Hearing with Hearables – Elevating Ambient Sounds, Own Voice, and Spatial Content

Hearables are one of the fastest growth markets in the world and consumers are expecting more and more features that go way beyond only audio quality.Within these features, the ones that are increasing the comfort of the user are becoming more and more important. This includes the control of ambient sounds, which can be attenuated via ANC, passed through with transparency features to create an open ear feeling or adjusted to individual perception of the user to mitigate hearing loss. Manual or automatic switching between personal space with silence by ANC and being open to the world by transparency is a demanded feature in current devices. However, where are the current challenges lying here? What are current approaches?The comfort of the user also includes the perception of the user's own voice, as well as any kind of body / movement sounds. Especially occluding headphones often create a "rumbling" feeling with movements and a muffled feeling for the user's own voice. This might be acceptable for very moderate use, but quickly leads to frustration with the users. It requires a smart solution. What are the major factors influencing how boomy something feels?Furthermore, the trend of spatial audio and externalizing sound with hearables outside the head of the user is currently getting a lot of attention. It is an extension of the real-world around the user, which can be attenuated, made transparent or enhanced. Spatial audio adds another layer on top, a virtual world, or desired audio content that the user wants to perceive. What is necessary for a convincing experience? For what audio content does it make sense? The presentation gives an overview of these concepts and the different layers of audio perception that are important for a hearable.For interested listeners two real-time demonstrations based on commercial silicon will be available after the talk. In our first demonstration, the topic of natural hearing is showcased. The demo combines occlusion cancellation, low noise wide-band transparency, and wideband ANC into a compelling solution for in-ear headphones. In our second demo we showcase Spatial Audio Immersion with headphones, which tackles the problem of motion-to-sound latency for wireless hearables and keeping the audio as purely preserved as possible without adding potentially unwanted artificial reverb.

Speech on 11th of October, State Room I, Audio

Mr. Aleksandr Timofeev (CEO) & Mr. Serge Kozhanov

PolyN Technology, France

Aleksandr Timofeev is CEO and Founder of POLYN Technology (https://polyn.ai), an innovative provider of ultra-low-power high-performance NASP (Neuromorphic Analog Signal Processing) technology. Aleksandr is a serial entrepreneur with 20-year experience in the high-tech industry. Prior to POLYN, he founded iGlass, a company that developed novel electrochromic smart glass technology. He built the core team, the technology and product concept, and successfully sold the company to a strategic investor. Aleksandr is also a founder and managing partner at FPI Innovation Fund LP, an early-stage venture investment management company. The fund focuses on early-stage innovative companies, developing clear product concepts and strategies and working with venture firms and partners for subsequent funding rounds.

Topic: Unleashing the Potential of Sensor-Based Processing with AI-Enhanced Products

POLYN Technology offers unexplored possibilities in product innovation with Neuromorphic Analog Front-End (NFE) technology that revolutionizes sensor-level data processing. It significantly reduces sensor data transmission and enhances efficiency, making it ideal for wearables. Neuromorphic Analog Front-End (NFE) is designed to extract only useful information from raw sensor data, reducing data transmission by over 1000 times. The analog neuromorphic core of NFE chip enables true parallel neural network execution, offering greater efficiency compared to traditional digital methods based on deterministic operations. Our product lines include: NeuroSenseTM: An ultra-low power AI chip for always-on monitoring of human activity and bio-parameters, enhancing wearables with vital sign data. This solution transforms wearable functionality by processing raw data from biosensors within its neural core and delivering heart rate variability, activity patterns, arrhythmia signs, and more vital data. NFE consumes microwatt-level power and can operate continuously, offering several weeks of monitoring on a single battery charge or on energy harvesting. NeuroVoiceTM: An ultra-low power AI chip product family providing voice detection and voice extraction, enchanting performance of various voice products, including smart microphones and voice control systems. NeuroVoice VAD - a solution for Smart Microphones, empowered by AI for efficient voice recognition and transmission, this compact 1mm2 chiplet can be integrated into various applications alongside MEMS or analog microphones. NeuroVoice SCV – a solution offering Smart Voice Control that overcomes the limitations of cloud-based voice control interface. It combines AI voice detection and extraction with keyword recognition. The always-on offline KWS (Keyword Spotting) module enables remote control of various devices such as Smart TVs, smart speakers, air conditioners lighting and more, addressing privacy concerns and sustainability. NeuroVoice VE – a Smart Hearing Support solution for TWS/OTC products that overcomes hearing difficulties, particularly in noisy environments. The on-device AI Voice Extraction module combined with Voice Activity Detection, converts TWS earbuds into hearing support devices, facilitating communication in challenging acoustic settings.


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Huawei Future Device Technology Summit

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Huawei Future Device Technology Summit Program

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