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PAINLESS

An innovative training network (ITN) on

Energy-autonomous portable access points for infrastructure-less networks

NEWSLETTER DATE
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Net-zero energy communications are key to i) enable 100% coverage in urban environments in a power-efficient manner ii) connect the remaining 3+ billion in areas with limited power grid infrastructure, iii) address network provisioning in emergency and disaster areas, and iv) materialize the identified global sustainability challenges and the climate crisis.

Inside this issue

PAINLESS RESEARCH PROJECTS' UPDATES

PAINLESS has recently conducted a Workshop on towards Net-zero communication networks in the IEEE conference on Vehicular Technologies VTC'22 in London

The aim of this workshop was to bring together academic and industrial researchers, showcase key results in the area, and identify and discuss the major technical challenges, recent breakthroughs, and new applications related to the topic of energy autonomous communications towards a net-zero energy operation. Several world-renowned speakers took part in our workshop to discuss the current state of the art in this domain.

VTC'22 Workshop, Invited Keynote Speakers

MOHAMED-SLIM ALOUINI

MOHAMED-SLIM ALOUINI (Fellow, IEEE) Professor Alouini general research interests include design and performance analysis of diversity combining techniques, MIMO techniques, multi-hop/cooperative communications systems, optical wireless communication systems, cognitive radio systems, green communication systems and networks, wireless communication systems and networks in extreme environments, and integrated ground-airborne-space networks. He is currently actively working on addressing the uneven global distribution, access to, and use of information and communication technologies by studying and developing new generations of aerial and space networks as a solution to provide connectivity to far-flung, less-populated, and/or hard-to-reach areas. Possibilities for Wireless Connectivity on the Path beyond 5G.

Ioannis Krikidis

Prof Ioannis Krikidis is an Associate Professor at the University of Cyprus. I am the director of the IRIDA Research Centre for Communication Technologies and the Mobile Communications and Networking (MCN) laboratory, which conduct research in the broad area of communication theory, communication signal processing, wireless communications and networks. A Consolidator grant holder and a Fellow of the IEEE.

Hardy Halbauer

Hardy Halbauer received the Diploma degree in electrical engineering from the Technical University of Karlsruhe in 1985. He joined Alcatel in 1985, where he worked on physical layer algorithms and ASIC design for high capacity microwave links. Since 1995 he is with the Alcatel Research Center, where he contributed to various national and European research projects with research work on physical layer design for different wireline and wireless communication systems. At Alcatel-Lucent Bell Labs, he worked on multi-antenna system design and signal processing algorithms for advanced wireless communication systems. His current research focus is on 3D beamforming, mm-wave system design and massive MIMO antenna array technology.

Pete James Co-Founder Director

Pete left his fifteen-year position as Chief Engineer Electronics at Prodrive Engineering Ltd. in 2011 and founded Lyra believing Power Electronics would play a significant part in the future of mobility. Pete chairs the Automotive and Road Transport System Technical Professional Network for IET and consults on the infrastructure surrounding automotive electrification.

VTC'22 Workshop, Overview

Overview: The workshop involved two keynote talks and two industrial talks from recognized academics and industrial researchers in the field. These were followed by two technical sessions aimed at presentations by several talks by our Early Stage Researchers as well as external participants into the workshop.

Novelty: The explosive growth of applications and industrial sectors that rely on broadband connectivity, is set to stretch the demand for wireless networks beyond the reach of the power grid infrastructure. The availability and reliability of the power grid is set to become a major bottleneck in providing broadband connectivity in future generations of wireless networks. Off-the-grid network nodes that are energy autonomous and thus portable will become indispensable in the next generations of wireless networks.

This imposes a complete re-think of technological solutions, and there is a necessity of efforts to pioneer green, energy-autonomous portable network nodes which are self-subsistent and limitlessly-scalable, to satisfy future demands with minimal infrastructure. This involves a paradigm shift by integrating and jointly optimising wireless networks with renewable energy sources, radiated energy harvesting and airborne access points, as well as establishing disruptive performance benchmarks, where currently none exist, for the combined wireless power-and-information distribution. Net-zero energy communications are key to i) enable 100% coverage in urban environments in a power-efficient manner ii) connect the remaining 3+ billion in areas with limited power grid infrastructure, iii) address network provisioning in emergency and disaster areas, and iv) materialize the EU's identified global sustainability challenges and the climate crisis.

Audience: The Workshop was targeted towards researchers from academia and industry, early stage researchers, and those interested in developing wireless technologies for addressing global challenges and climate change. Moreover, we had received a good number of attendees – about 30 – due to the relevance of the technical areas addressed and the participation of world-class speakers, which have already confirmed their presence. Overall, we have received 24 submissions, out of which we expect to accommodate 10 between papers and posters, corresponding to an acceptance rate of 40%.

The organizing committee promoted contributions from the TPC members as well as from other well-known researchers both in industry and academia. The submitted papers were peer-reviewed by a minimum of three independent reviewers in the field to ensure a high-quality standard.

Workshop Co-chairs

Prof. Christos Masouros, University College London, UK (c.masouros@ucl.ac.uk)
Dr. Jimmy Nielsen, Aalborg University, DE (jjn@es.aau.dk)
Prof. Constantinos Papadias, American College of Greece, GR (cpapadias@acg.edu)

Steering Committee

Dr. Pete James, Lyra Electronics, UK (pete@lyraelectronics.com)
Dr. Alvaro Valcarce, Nokia, FR (alvaro.valcarce_rial@nokia-bell-labs.com)
Prof. Petar Popovski, Aalborg University, DE (petarp@es.aau.dk)
Dr. Emad Alsusa, University of Manchester, UK (E.Alsusa@manchester.ac.uk

VTC'22 Workshop, Full Program

TIME	TOPIC
9:00-9:10	Workshop Welcome and PAINLESS introduction Christos Masouros
9:10-9:50	Keynote 1 Ioannis Krikidis: "Wireless Information and Energy Transfer in the Era of 6G Communications"
9:50-10:30	Industrial Talk 1 Hardy Halbauer: "Towards Power Efficient Transmission for 6G Communication Systems"
10:30-11:00	Coffee and Poster Break
11:00-12:30	Technical Session 1: Communications beyond the reach of the power grid (5 papers – 18min each, incl. questions) **Cost-Efficient Deployment of a Reliable Multi-UAV Unmanned Aerial System** Nithin Babu, The American College of Greece **Enabling On-Demand Cyber-Physical Control Applications with UAV Access Points** Igor Donevski, Jimmy Jessen Nielsen, Aalborg University **Optimizing IRS-Assisted Uplink NOMA System for Power Constrained IoT Networks** Mahmoud AlaaEldin, University of Manchester; Emad Al-Susa, Manchester University; Karim Seddik, American University in Cairo; Mohammad Al-Jarrah, University of Manchester **Resource Allocation Policies for Hybrid Power-Grid and Harvested Energy Communication Systems** Iman, University College London **Path Design for Portable Access Point in Joint Sensing** Xiaoye Jing, UCL; Fan Liu, Southern University of Science and Technology, China; Christos Masouros, University College London
12:30-14:00	Lunch Break
14:00-14:45	Keynote 2 Mohamed-Slim Alouini: "Towards connecting the remaining 3+ billion"
14:45-15:30	Industrial Talk 2 Pete James: "Energy storage technologies for renewable energy powered communication networks"
15:30-16:00	Coffee and Poster Break
16:00-17:30	Technical Session 2: Energy Harvesting (5 papers – 18min each, incl. questions) **Multi-Site Energy Harvesting for Battery-Less Internet-of-Things Devices: Prospects and Limits** Morteza Esmaeili Tavana, Emil Björnson, KTH Royal Institute of Technology; Jens Zander, KTH Royal Institute of Technology, Sweden **A Linear MMSE Receiver for SWIPT-enabled Wireless Network** Yuan Guo, Christodoulos Skouroumounis, Ioannis Krikidis, University of Cyprus **Black-box model for estimating efficiency curves in DC-DC converters for energy storage systems** Marco Virgili, University of Manchester; Pete James, Lyra Electronics; Andrew Forsyth, University of Manchester **Empirical Characterization of Solar Panel Outlay and Dimension for Net-Zero Energy IoT System** Dr. Sudhakar Modem, Indian Institute of Technology Jammu; Deepak Mishra, University of New South Wales; Sudhakar Modem, Indian Institute of Technology Jammu **PV-Powered Base Stations Equipped by UAVs in Urban Areas** Mahshid Javidsharifi, Aalborg University; Hamoun Pourroshanfekr Arabani, Lund University; Tamas Kerekes, Aalborg University; Dezso Sera, Queensland University of Technology; Josep M. Guerrero, Aalborg University
17:30	Closing of workshop

Sample Pictures from the Event

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