

## Keynotes

### 1. Centenary of URSI and the Finnish Member Committee

Ari Sihvola, Aalto University

Abstract: One hundred years ago, our union URSI (Union radioscopique internationale) was founded in Brussels under the name Union international de radiotélégraphie scientifique. The first General Assembly of the Union was held in July 1922 in Brussels. Hence our radioscientific community has the opportunity to celebrate the centennial over three years 2019–2022! This presentation gives a short view on the history of both radio science in Finland and the Finnish Member Committee of URSI, founded in 1952.

Ari Sihvola received the degree of Doctor of Technology in 1987 from the Helsinki University of Technology, Finland (presently Aalto University). Besides working for TKK, Aalto, and the Academy of Finland, he was visiting engineer in the Research Laboratory of Electronics of the Massachusetts Institute of Technology, Cambridge, in 1985–1986. In 1990–1991, he worked as a visiting scientist at the Pennsylvania State University, State College. In 1996, he was visiting scientist at the Lund University, Sweden. He was visiting professor at the Electromagnetics and Acoustics Laboratory of the Swiss Federal Institute of Technology, Lausanne (academic year 2000–01), in the University of Paris 11, in Orsay (June 2008), and in the University of Rome La Sapienza (May–June 2015). His research interests include waves and fields in electromagnetics, modeling of complex media and metamaterials, remote sensing, education in physics, and history of electrical engineering. He is presently professor in the School of Electrical Engineering at the Aalto University. Ari Sihvola is Vice President of the International Union of Radio Science (URSI) the Chairman of the URSI Finnish Member Committee.

### 2. Trends and challenges from 5G towards 6G

Aarno Pärssinen, University of Oulu

Abstract: Commercial ramp up of fifth generation wireless communications is on-going with the set of new requirements from latency to bandwidth for new and enhanced applications and services. One of the key new enablers is the adaptation of mmW bands and devices supporting those also for personal use. This has major impact for RF design both in base stations and in mobile devices bringing large scale antenna arrays and related electronics into mass markets.

When industry is highly focused on bringing 5G to market academia is already starting to look visions and technology enablers for the next generation. Academy of Finland 6G Flagship program at University of Oulu focuses on new opportunities from fundamental technologies to trials in this field. In this presentation, the first vision towards next generation radio technologies for communications and sensing is shared and then some key challenges to achieve those will be discussed specifically focusing on radio implementation aspects.

Aarno Pärssinen received the M.Sc., Licentiate in Technology and Doctor of Science degrees in electrical engineering from the Helsinki University of Technology, Finland, in 1995, 1997, and 2000, respectively. In 1996, he was a Research Visitor at the University of California at Santa Barbara. From 2000 to 2011 he was with Nokia Research Center, Helsinki, Finland. During 2009-2011 he served as a member of Nokia CEO Technology Council. From 2011 to 2013, he was at Renesas Mobile Corporation, Helsinki, Finland working as a Distinguished Researcher and RF Research Manager. In 2013 he joined Broadcom, Helsinki, Finland as part of business acquisition and worked as an Associate Technical Director until September 2014. Since September 2014 he has been with University of Oulu, Centre for Wireless Communications, Oulu, Finland where he is currently a Professor. He is currently leading Devices and Circuits research area in 6G flagship program financed by Academy of Finland.

His research interests include wireless systems and transceiver architectures for wireless communications with special emphasis on the RF and analog integrated circuit and system design. He has authored and co-authored one book, two book chapters, more than 100 international journal and conference papers and holds several patents. He is also one of the original contributors to Bluetooth low energy extension, now called as BT LE. He served as a member of the technical program committee of Int. Solid-State Circuits Conference in 2007-2017, chairing the wireless subcommittee in 2014-2017.

### 3. Mobile Antenna Challenges and Opportunities

Ville Viikari, Aalto University

Abstract: Cellular networks consume about 0.5 % of all the electricity produced in the world. Majority of that power is used to generate radio waves and the energy needed depends directly on the antennas' ability to transfer waves from the transmitter to the receiver. Current mobile antennas are fairly inefficient in this task. An antenna of a mobile device uses radio frequency energy to mainly heat up the device and the user converting only a fraction of the available energy to radiating waves. Furthermore, mobile antennas do not particularly direct the waves towards the recipient.

This presentation discusses mobile antenna challenges and considers opportunities related to mm-wave frequencies, higher antenna-IC integration. In particular, new antenna method based on clusters of collaborative radiators is presented. The presentation gives examples on how to use the cluster method for systematic antenna design and how to realize adaptive antennas with it.

Ville Viikari received the Doctor of Science (Tech.) (with distinction) degree in electrical engineering from the Helsinki University of Technology (TKK), Espoo, Finland, in 2007. He is currently an Associate Professor and Deputy Head of Department with the Aalto University School of Electrical Engineering, Espoo, Finland. From 2001 to 2007, he was with the Radio Laboratory, TKK, where he studied antenna measurement techniques at submillimeter wavelengths and antenna pattern correction techniques. From 2007 to 2012, he was a Research Scientist and a Senior Scientist with the VTT Technical Research Centre, Espoo, Finland, where his research included wireless sensors, RFID, radar applications, MEMS, and microwave sensors. His current research interests include antennas for mobile devices and networks, RF-powered devices, and antenna measurement techniques.

Among other awards, Viikari was the recipient of the 2008 Young Scientist Award of the URSI XXXI Finnish Convention on Radio Science, Espoo, Finland