IEEE Distinguished Lecture and ISSS Seminar

Many names, many advantages – from Trentini to beam steering of modern (Fabry-Perot) Resonant Cavity antennas.

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Date & Time: 27th March 2024, 2:30 PM to 4 PM (UK Time).

Location: Room EM2.33, Earl Mountbatten Building,
School of Engineering and Physical Sciences,
Heriot-Watt University, Edinburgh, UK.

Abstract: No other antenna concept has more names. At present these antennas are known as Fabry-Perot resonant cavity antennas, just Resonant Cavity Antennas (RCA), Partial Reflector Surface (PRS) based antennas, Electromagnetic Band Gap (EBG) Resonator antennas (ERAs) and Two-Dimensional Leaky-Wave Antennas, and more names are forthcoming. Yet they all have more or less the same configuration consisting of a resonant cavity, formed between a partially reflecting superstructure and a fully reflecting (ground) plane. The resonant cavity is excited by a small feed antenna. Hence, they are referred to as resonant cavity antennas (RCAs) in this presentation. Since the concept of using a "partially reflecting sheet array" superstructure to significantly enhance the directivity was disclosed by Trentini in 1956, it has been an attractive concept to several antenna researchers for several reasons, including its theoretical elegance, relationships to other well-researched area such as leaky-waves, EBG, frequency selective surfaces and metasurfaces, and practical advantages as a low-cost simple way to achieve high-gain (15-25 dBi) from an efficient planar antenna without an array, which requires a feed network. The RCA concept is one of the main beneficiaries of the surge of research on electromagnetic periodic structures in the last decade, first inspired by EBG and then to some extent by metamaterials. As a result, RCAs gained a tremendous improvement in performance in the last 10 years, in addition to other advantages such as size reduction. As an example, achieving 10% gain bandwidth from such an antenna with a PSS was a major breakthrough in 2006 but now there are prototypes with gain bandwidths greater than 50%. Until recently most RCAs required an area in the range of 25-100 square wavelengths but the latest extremely wideband RCAs are very compact, requiring only 1.5-2 square wavelengths at the lowest operating frequency. Once limited to a select group of researchers, these advantages have attracted many new researchers to RCA research domain, and the list is growing fast, as demonstrated by

the diversity of authors in recent RCA publications. RCAs have already replaced other types of antennas, for example as feeds for reflectors.

This presentation will take the audience through historical achievements of RCA technology, giving emphasis to breakthroughs in the last 20 years up to a recent method of steering its beam continuously in 2D (i.e., azimuth and elevation).

Speaker Biography: Karu Esselle is the Distinguished Professor in Electromagnetic and Antenna Engineering at University of Technology Sydney. He is Australia's 2022 Professional Engineer of the Year, and the leader of the MetaSteerers Team that won Australia's national 2023 Eureka Prize for Outstanding Science in Safeguarding Australia. Eureka Prizes are considered Oscars of Australian Science. Karu is the only person to receive both a Eureka Prize and the Professional Engineer of the Year Award. He is a Fellow of the Royal Society of New South Wales, IEEE and Engineers Australia. In the 24-month period to December 2023, ten new awards and prizes expanded Kau's portfolio of Research Excellence accolades. These include the most prestigious Space award in Australia – the "Winner of Winners" Excellence Award – as well as the Academic of Year Award at the 2022 Australian Space Awards, 2022 Chancellor's Medal, both the Excellence Award and the Academic of the Year Award at 2021 Australian Defence Industry Awards, and 2019 Motohisa Kanda Award (from IEEE USA) for the most cited paper in IEEE Transactions on EMC in the past five years.

Karu has authored over 700 research publications and his papers have been cited over 15,000 times. His h-index is 61. Since 2002, his research income is over 33 million dollars. Karu has provided expert assistance to more than a dozen companies in USA, Europe and Australia. From 2018 to 2020, Karu chaired the prestigious Distinguished Lecturer Program Committee of the IEEE Antennas and Propagation (AP) Society. He has served or is serving in 8 global committees of this IEEE society.

In addition, Karu is a Senior Editor of IEEE Access and has served as an Associate Editor for all major journals in his fields including IEEE Transactions on Antennas Propagation. Previously he was Director of WiMed Research Centre and Associate Dean – Higher Degree Research (HDR) at Macquarie University. He has also served as a member of the Dean's Advisory Council and the Division Executive.