



High Gain Millimeter Wave Antennas for 5G Wireless Systems

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Recently, there has been increasing interest and rapid growth in millimeter (mm)-wave antennas and devices for use in diverse applications, services, and technologies such as short-range communication, future mm-wave mobile communication for the fifth generation (5G) cellular networks, and sensor and imaging systems. Due to the corresponding smaller wavelength, mm-wave frequencies offer the advantage of physically smaller antennas and circuits as well as the availability of much wider bandwidth compared to microwave frequencies. In addition, they provide additional spectrum for wireless communications. The planned 5G cellular networks base stations and mobile devices will essentially make use of mm-wave frequency bands to meet consumers' ever-growing demand for high data rate and capacity from wireless service providers.

Millimeter-wave antenna design is considered as the first step for realizing mm-wave wireless communication and imaging systems. Design requirements for such antennas include highly directional patterns – for long transmission range and high detection sensitivity - and size reduction with a suitable impedance matching bandwidth. This talk will address the market demand for compact highly efficient antennas for next generation wireless communications, sensing and imaging systems. The main part of the talk will focus on investigation and development of mm-wave high gain broadband antenna elements and arrays that cover multiple mm-wave frequency bands to serve several applications. Antennas with high gain produce very directive narrow beam for high resolution sensing as well as reduce the demand for power requirements and consumptions by wireless systems. In addition, the talk will also discuss the development of frequency selective surface (FSS), and their diverse applications in millimeter-wave electromagnetic spectrum.

The talk will also present the most recent research activities at Concordia University highlighting, in particular, development of mm-wave antennas, couplers, and beamforming using the emerging printed ridge gap waveguide (PRGW) technology.



Biography of Prof. Abdelrazik Sebak, (عبد الرازق سبّاق), Ph.D., P. Eng., IEEE Fellow, EIC Fellow



Dr Abdel Razik Sebak is a Tier I Concordia University Research Chair in mm-wave antennas and systems. Before joining Concordia University, he was a professor at the University of Manitoba. He was also with Cairo University and worked with the Canadian Marconi Company on the design of microstrip phased array antennas.

Dr Sebak's recent research activities cover two streams: Antenna Engineering, and Analytical and Computational Electromagnetics. Applied and sponsored projects include high gain mm-wave antennas, advanced composite materials for aerospace shielding and antenna applications, microwave sensing and imaging, ultra-wideband antennas, and microwave beamforming. Dr. Sebak's original research contributions and technical leadership have been extensive and resulted in over 500 publications in prestigious refereed journals and international conference proceedings.

Dr Sebak was inducted as a Fellow of the Institute of Electrical and Electronics Engineers in 2009. He is also a Fellow of the Engineering Institute of Canada. Dr. Sebak is a member of Concordia University Provost's Circle of Distinction for his career achievements. For his joint efforts in establishing one of the most advanced electromagnetic computational and antennas labs at the University of Manitoba, Dr. Sebak received the Rh Award for Outstanding Contributions to Scholarship and Research. Dr. Sebak received the 1992 and 2000 University of Manitoba Merit Award for outstanding Teaching and Research. In 1996 Dr. Sebak received the Faculty of Engineering Superior Academic Performance. Dr Sebak has also received the IEEE Antennas and Propagation Society Best Chapter Award.

Dr. Sebak has served as the General Chair of IEEE-ANTEM2016 Symposium and Co-Chair of the IEEE ICUWB2015. He has also served as Chair for the IEEE Canada Awards and Recognition Committee (2002-2004), IEEE Canada Conference Committee (2000-2002) and as the Technical Program Chair for the 2002 IEEE CCECE Conference and the 2006 URSI-ANTEM Symposium. He has also served as a member (2002-2004) of the IEEE RAB Awards and Recognition Committee. Dr. Sebak has served as Associate Editor, Journal of Applied Computational Electromagnetic Society, Associate Editor, International Journal of Antennas and Propagation. Associate Editor, J. Engineering Research. He is a member of the Canadian National Committee of International Union of Radio Science (URSI) Commission B.