Graduate Seminar (EEL 6936)
Department of Electrical Engineering
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CUTR Building, CUTR 202

UWB Antennas for Wireless Communication and Detection Applications

Abstract

Ultra-wide band (UWB) wireless communication occupies a bandwidth from 3.1 to 10.6 GHz, referred to as UWB band, to achieve high data rate over a short distance. Two competing schemes, namely multiband orthogonal frequency division multiplexing (MB-OFDM) and direct sequence ultra wide band (DS-UWB), were proposed to make use of the allocated bandwidth. Ideally, a transmitting/receiving UWB antenna pair comprising a communication channel should operate as a band-pass filter covering the UWB band and have a flat magnitude response and a linear phase response with frequency. It requires an UWB antenna well matched, with frequency independent phase center, and linearly increasing gain with frequency over the entire UWB band. An omnidirectional UWB antenna is especially attractive to wireless communications at either base station or terminal side. For an omnidirectional UWB antenna, besides the aforementioned three requirements, its radiation performances over the UWB band should also be independent of the azimuth angle. A good impedance matching over the UWB band is not difficult, and many types of antenna can achieve that. Frequency independent phase center is achievable for most antennas except for those with multi-resonant structure spatially separated. But, after the first three requirements are met, a wideband omnidirectional radiation is still challenging for UWB antenna design. Omnidirectional UWB antennas with a non-planar conducting structure as well as DRA are presented for an UWB access point. Another recently addressed problem is the interference problem with the WLAN bands. To prevent interference problems due to existing nearby communication systems within an Ultra-wideband operating frequency, the significance of an efficient band notched design is increased. Two novel antennas are presented. One antenna is designed for one band-notch. The second antenna is designed for dual band-notches. Several UWB antennas with unidirectional patterns are presented for detection applications. Dielectric resonator is used to tremendously shrink an UWB antenna's size to be used as a sensor for breast cancer detection and microwave imaging. Another 3D conducting self-grounded Bow-Tie sensor is presented. The application of such a DR UWB antenna for thro-wall radar detection is also investigated showing better performance as compared to the Vivaldi antenna

Biography

Ahmed Kishk is a Professor at Concordia University, Montréal, Québec, Canada (since 2011) as Trier 1 Canada Research Chair in Advanced Antenna Systems. From December 1985-2011, he was a Professor at University of Mississippi. He was on sabbatical leave at Chalmers University of Technology, Sweden during the 1994-1995 and 2009-2010. He was an Associate Editor, a Feature Articles Editor, and Associate Editor of Antennas & Propagation Magazine (1990-1993), (1993-2014), and (2015-present), respectively. He is a distinguish lecturer for the Antennas and Propagation Society (2013-2015). He was an Editor-in-Chief of the ACES Journal from 1998 to 2001. He was the chair of Physics and Engineering division of the Mississippi Academy of Science (2001-2002). He is a member of the AP AdCom (2013-2015).His research interest includes the areas of Dielectric resonator antennas, microstrip antennas, small antennas, RFID antennas for readers and tags, Multi-function antennas, microwave circuits, EBG, artificial magnetic conductors, soft and hard surfaces, and phased array antennas. He has published over 250-refereed Journal articles and 380 conference papers. He is a coauthor of four books and several book chapters and editor of three books. Dr. Kishk and his students have received several awards. Dr. Kishk received the 1995 and 2006 outstanding paper awards for papers published in the Applied Computational Electromagnetic Society Journal. He received the Microwave Theory and Techniques Society Microwave Prize 2004. He received 2013 Chen-To Tai Distinguished Educator Award of the IEEE Antennas and Propagation Society. In recognition "For contributions and continuous improvements to teaching and research to prepare students for future careers in antennas and microwave circuits." Dr. Kishk is a Fellow of IEEE since 1998, Fellow of Electromagnetic Academy, and Fellow of the Applied Computational Electromagnetic Society (ACES).