

Microwave Lens Antennas

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Abstract

The rapid development of wireless technology has greatly increased the applications of multibeam antenna technology. Usually antenna arrays or reflector antennas are the good candidates for multibeam design with complicated RF or digital systems. On the other hand, the classic lens can be used to generate multiple beams naturally by locating the feeds at different positions behind the lens to form a multibeam lens antenna. Compared with reflector antennas, the usage of lens antenna avoids the blockage by feeds. Furthermore the all high-gain beams generated by a lens antenna share the same aperture while the multibeam antenna arrays occupy much large aperture with lossy feeding structures. Conventional lenses are fully constructed by bulky dielectric. The flat, lightweight and PCB-based metasurface lenses have been developed for multibeam antennas. This talk will introduce the concepts of metasurfaces and then the technology of metasurface-based lenses at microwave bands. After that, the recent progress in the research and development of microwave metasurface lens antennas is updated with designs examples. Last, some of the multibeam lens antennas developed published and applied in 5G wireless network by our group from National University of Singapore will be introduced.

Zhi Ning Chen received his BEng, MEng, and PhD degrees all in Electrical Engineering from the Institute of Communications Engineering (ICE), China and his second PhD degree from the University of Tsukuba, Japan, respectively. Dr Chen has published 680+ academic papers and six books entitled Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems (IEEE Press Series on Electromagnetic Wave Theory, May 2021), Broadband Planar Antennas (Wiley 2005), UWB Wireless Communication (Wiley 2006), Antennas for Portable Devices (Wiley 2007), Antennas for Base Stations in Wireless Communications (McGraw-Hill 2009), and Handbook of Antenna Technologies with 76 chapters (by Springer References in 2016 as an Editor-in-Chief). He has also contributed the chapters to the books entitled Developments in Antenna Analysis and Design (IET 2018), UWB Antennas and Propagation for Communications, Radar, and Imaging (Wiley 2006), Antenna Engineering Handbook (McGraw-Hill 2007), Microstrip and Printed Antennas (Wiley 2010), and Electromagnetics of Body Area Networks (Wiley 2016). Dr Chen is holding 33 granted/filed patents and completed 38+ technology licensed deals with industry. He is pioneering in developing small and wideband/ultra-wideband antennas, wearable/implanted medical antennas, package antennas, near-field antennas/coils, three-dimensional integrated LTCC arrays, microwave lens antennas, microwave metamaterial-metasurface antennas for communications, sensing, and imaging systems. Dr Chen was elevated the Fellow of Academy of Engineering, Singapore in 2019 and a Fellow of the IEEE for the contribution to small and broadband antennas for wireless applications in 2007. He has served IEEE Council on RFID as a Vice President and a Distinguished Lecturer since 2015. He served IEEE Transaction on Antennas and Propagation as an Associate Editor and IEEE Antennas and Propagation Society as a Distinguished Lecturer...