PREFACE

Modern communication has expanded significantly in recent years across multiple frequency bands due to wide impedance bandwidths, high device density, low latency, and the growth of transceiver antennas. As a result, the antenna designers have faced a substantial challenge in miniaturization without compromising the performance. Due to the rapid growth of existing wireless communication networks, the antenna designers have begun to put significant emphasis on the realization of compact and inexpensive multiband antennas due to their frequency reusability and increased channel capacity. Metasurface antennas (MSAs) are more versatile in comparison to the conventional antennas in meeting a variety of requirements for wireless communications applications. Additionally, by placing MSAs, the constraint on the relative position of transmitting and receiving antennas can be reduced, hence decreasing the possibility of inconsistent wireless network disturbances. The metasurface is a two-dimensional periodic structure in which the lattice spacing is too minimal to scatter electromagnetic waves. Additionally, MS structures exhibit flexible reflection characteristics and controlled dispersion properties in various applications, including absorbers, polarisation converters, antennas, and filters. MSA designs have the ability to generate highly directed radiation patterns with far-field characteristics.

The metasurface is used in the development of high-performance antennas, which include a variety of radiating elements such as patch antennas, slot antennas, and coplanar waveguide-fed antennas (CPW-fed) antennas. Planar technology is used to study and implement all the structures. The MS is placed on top or at the bottom, or both are taken together, depending on the application. Planar antennas are frequently conformable, low-profile, simple to integrate, and inexpensive to manufacture.

However, they have low directivity and generate surface waves, which is incompatible with the system's requirements. The use of electromagnetic band-gap materials, artificial magnetic conductors (AMCs), resonant layers, fabry-perot (FP) cavities, and metasurfaces can improve the performance of planar antennas. On the other hand, monopole antennas have a restricted bandwidth and a low gain. Thus, radiating elements with MS can enhance the performance of antennas to a certain point.

The author, from time to time, has reported the present work part-wise at national and international conferences as well as in reputed journals, namely, International Journal of RF and Microwave Computer-Aided Engineering, IEEE Transactions on Antennas and Propagation, Radio Science, and IEEE Antenna Wireless Propagation Letters.

The author will consider his modest effort a success if it proves to be useful in the modern era of wireless communication systems with multi-standard operations.