Special Issue on Low-Cost Wide-Angle Beam-Scanning Antennas

Guest Editors

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Description: One of the key requirements in modern wireless systems is beam-scanning antennas. The traditional method is to employ mechanically beam-scanning reflectors which are, however, bulky, heavy, and have slow speed of beam scanning. Other important limitations of mechanical scanners is their lack of multi-beam scan capability and ability to conform with non-planar structures (conformal geometries), which are essential in a number of emerging systems requiring very low-profile structures. An alternative technique is to employ electronically beam-scanning antennas using passive or active phased arrays. Main disadvantages of phased arrays are high complexity, high power consumption and high cost due to a large number of radio frequency (RF) or microwave phase shifters and T/R modules required. The problems get worse for phased arrays at millimeter-wave, sub-THz and THz frequencies, due to significant losses in phase shifters and feed networks at higher frequencies. The digital beam-forming approach is even more costly and energy hungry due to the employment of a large number of RF modules and digital devices. For civilian applications, it is critical to develop low-cost beam-scanning antenna technologies. There are significant interests from the industries (terrestrial, maritime, and space) and academics in investigating innovative development of low-cost beam-scanning antennas worldwide. Low-cost beam-scanning antennas are very promising for a wide range of applications such as the base stations and mobile phones of 5G/B5G/6G, mobile terminals for satellite communications on the move, automotive radars, imagers, small satellites data downlink, small satellites inter-satellite links, Internet of Things, Internet of Space, etc. For example, Starlink, initiated by SpaceX, aims to deliver high speed broadband internet and global coverage from space. One of key challenges for Starlink is the high cost of beam-scanning antennas for user terminals on the ground. To ensure the success of Starlink project, SpaceX will have to find a way of developing the user terminal antennas at very low cost.

The purpose of this special issue is to draw attention to the latest progress in the theory, design, development, and in-field deployment of low-cost beam-scanning antennas for applications in base stations of mobile communications networks, mobile phones, mobile terminals for satellite communications on the move, radars, small satellites (Cube-Sat, Micro-Sat, Mini-Sat, Nano-Sat, Pico-Sat), Internet of Things, etc. Contributions are sought for, but not limited to the following:

- Novel theory or techniques of designing low-cost wide-angle compact-size beam-scanning antennas at microwave, millimeter-wave, sub-THz or THz frequencies;
- New configurations and techniques for wide-angle beam-scanning phased array antennas with low complexity;
- Novel devices (phase shifters, etc.) or materials (artificial materials, functional materials, etc.) and their applications into practical implementation of low-cost power-efficient beam-scanning antenna systems;
- Beam-forming algorithms and their application into practical implementation of low-cost power-efficient beam-scanning antenna systems;
- Intelligent electromagnetic surfaces and their applications in practical implementation of beam-scanning compact-size antenna systems;
- New configurations and techniques for high-gain multi-beam antennas or high-gain beam-switched antennas;
- Manufacturing technologies for low-cost beam-scanning antennas;
- Multi-physics analysis and co-design of beam-scanning antenna sub-system and other subsystems (e.g. thermal sub-system, mechanical structures, power sub-system, etc.) or platforms;
- Measurement and calibration techniques, particularly on-line (integrated or internal) calibration/characterization schemes, for beam-scanning antennas.

Deadlines

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