IEEE AWPL Special Cluster 2025 on "Emerging Beam Steering Technologies of Antenna Systems for Millimeter-wave and Beyond Communications"

Millimeter-wave(mmW) and beyond have attracted plenty of attention and interest in both academic and industry owing to their advantageous features, including high data transmission rates, sufficient capacity, and low latency, to name a few. However, the intrinsic challenges of significant free space path loss and shadow effects at the millimeter-wave band and beyond impose stringent requirements on antennas to maintain the link budget. One crucial feature of the mmW and beyond antennas is beam steering, indicating that the antenna can switch beams so as to track and communicate mobile or multiple users efficiently. Considering the high-efficiency and energy-efficient 5G mmW and beyond cellular and satellite communications, it necessitates the development of innovative beam-steering techniques to cater to the evolving requirements. Both the industrial and academic sectors have duly acknowledged these challenges and are spearheading the research and development of beam-steering technologies.

This special cluster aims to provide an international forum for researchers to disseminate their latest findings on the techniques, applications and understanding in realizing various innovative beam steering technologies. The topics are expected to cover new theories, new methods, new materials, and new algorithms for the innovative beam steering technologies. These endeavors aim to fundamentally reshape the conventional design paradigms of beam-steering technologies on the antennas or array systems for future wireless communications. The editors welcome theoretical and experimental works that address the following topics (but not limited) to beam steering technologies:

- New materials such as meta-materials, liquid crystal, low-temperature superconducting materials, graphene, etc. for realizing beam steering capability.
- New manufacturing technologies such as 3D and 4D printing and laser cutting, etc. for fabricating beam steering antennas.
- New artificial intelligent algorithms such as machine learning and deep learning used to obtain high-performance meta-surface for beam steering capability.
- Improvement of the scanning performance of the antenna systems for large scanning range, simple structure and low-cost but good performance, low gain loss in the scanning range, etc.
- New design theories and applications of concepts such as new scanning concept and methods to explore and develop new beam steering technologies, including some interdisciplinary methods such as AI-driven control algorithms, hybrid analog-digital beamforming, etc.

The Guest Editors of this special Cluster are:

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Prospective authors are encouraged to contact the Guest Editors for any questions or to determine the suitability of their contribution for this special cluster. Papers should be prepared following the same submission instructions as for regular IEEE AWPL manuscripts (four-pages technical content maximum and one reference page, double-column, IEEE format), available via the Information for Authors website. The authors should indicate in the cover letter to the Editor-in-Chief that the manuscript is being submitted in response to the Call for Papers for the focused cluster. Prospective authors should refer to the timeline below for key dates.

Key dates:

• Submission deadline: **March 31, 2025**
• First decision: May 15, 2025
• Revised manuscripts deadline: June 15, 2025
• Final decision: July 30, 2025
• Final manuscripts due by: September 1, 20255
• Online publication: Shortly after final manuscript submission
• Cluster publication: November (or December) 2025 issue of AWPL