White Rose Research Online

eprints@whiterose.ac.uk
https://eprints.whiterose.ac.uk
Universities of Leeds, Sheffield and York

Deposited via The University of Sheffield.

White Rose Research Online URL for this paper:
https://eprints.whiterose.ac.uk/id/eprint/196065/

Version: Published Version

Article:
Liu, W., Madanayake, A., Yu, L. et al. (2023) Recent advances in design and signal processing for antenna arrays 2020. International Journal of Antennas and Propagation, 2023. 9843456. ISSN: 1687-5869

https://doi.org/10.1155/2023/9843456

Reuse
This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here:
https://creativecommons.org/licenses/

Takedown
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

UNIVERSITY OF LEEDS
University of Sheffield
UNIVERSITY of York

Hindawi
International Journal of Antennas and Propagation
Volume 2023, Article ID 9843456, 2 pages
https://doi.org/10.1155/2023/9843456

Editorial

Recent Advances in Design and Signal Processing for Antenna Arrays 2020

Wei Liu,[1] **Arjuna Madanayake**,[2] **Lei Yu**,[3] **Qing Shen**,[4] **and Jingjing Cai**[5]

[1]*University of Sheffield, Sheffield, UK*
[2]*Florida International University, Miami, FL, USA*
[3]*Harbin Institute of Technology, Harbin, China*
[4]*Beijing Institute of Technology, Beijing, China*
[5]*Xidian University, Xi'an, China*

Correspondence should be addressed to Wei Liu; w.liu@sheffield.ac.uk

Received 14 May 2022; Accepted 14 May 2022; Published 3 February 2023

Copyright © 2023 Wei Liu et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Compared with a single physical antenna, an antenna array has the capability for effective interference suppression/beamforming, direction of arrival (DOA) estimation, target tracking, and localization with its additional spatial degrees of freedom (DOFs) exploited by advanced signal processing algorithms [1–4]. It has received considerable attention given its wide range of applications in radar, sonar, sensor networks, navigation, biomedical engineering, wireless communications, etc., and one good example is the 2020 IEEE 5-Minute Video Clip Contest (5-MICC) about beamforming with more than 5000 researchers casting their votes in the process [5]. In particular, the antenna array design and signal processing is one of the fundamental techniques in wireless communication systems of the 5G and beyond since the two underpinning 5G technologies, massive multiple-input multiple-output (MIMO) and millimetre wave communications, are all based on antenna array systems [6, 7]. It will continue playing a significant role in many other aspects in the future, such as Internet of Things (IoT) and integrated sensing and communication (ISAC) [8–10], both of which are potential technologies for 6G wireless communication systems and intelligent transportation systems with extensive research activities already attracted in the community.

Given the continued importance of design and signal processing for antenna arrays and also following the success of the first special issue published in 2016 focusing on the same topic [11], we were approached by the journal office to organize a second special issue with the same topic. The aim of this current special issue is to present the most recent advances in the area of design and signal processing for various antenna arrays and their applications, by inviting both review articles and original contributions from researchers working in this very important area, and in total, we received 15 submissions and 6 were accepted for publication.

The accepted papers cover a wide range of topics within the specified area of the special issue. Roughly speaking, they fall into the following four main topics. The first topic is antenna design for array applications, including one paper titled "Development of a Pin Diode-Based Beam-Switching Single-Layer Reflectarray Antenna" [12]; the second topic is antenna array pattern synthesis, including one paper titled "Two-Dimensional Beampattern Synthesis for Polarized Smart Antenna Array and Its Sparse Array Optimization" [13]; the third topic is direction/angle of arrival estimation, including two papers, titled "Thinned Virtual Array for Cramer Rao Bound Optimization in MIMO Radar" and "Nonuniformly Spaced Array with the Direct Data Domain Method for 2D Angle-of-Arrival Measurement in Electronic Support Measures Application from 6 to 18 GHz" [14, 15], respectively; the last topic is target detection and localization (range/velocity/angle estimation) based on antenna arrays, including two papers, titled "Spread Sea Clutter Suppression in HF Hybrid Sky-Surface Wave Radars Based on General Parameterized Time-Frequency Analysis" and "Maximum Likelihood Angle-Range Estimation for Monostatic FDA-MIMO Radar with Extended Range Ambiguity Using Subarrays" [16, 17], respectively.

Conflicts of Interest

We declare no conflicts of interest regarding the publication of this special issue.

Acknowledgments

Finally, we would like to thank the authors for their valuable contributions to this special issue and the anonymous reviewers for their kind help and constructive comments, without which we would not have been able to complete this special issue with the set of high-quality papers in such a short period of time.

Wei Liu
Arjuna Madanayake
Lei Yu
Qing Shen
Jingjing Cai

References

[1] R. T. Compton, *Adaptive Antennas: Concepts and Performance*, Prentice-Hall, Englewood Cliffs, NJ, 1988.

[2] H. L. Van, *Trees, Optimum Array Processing, Part IV of Detection, Estimation, and Modulation Theory*, Wiley, New York, 2002.

[3] W. Liu and S. Weiss, *Wideband Beamforming: Concepts and Techniques*, John Wiley & Sons, Chichester, UK, 2010.

[4] Q. Luo, S. Gao, W. Liu, and C. Gu, *Low-cost Smart Antennas*, John Wiley & Sons, 2019.

[5] W. Liu, M. R. Anbiyaei, X. Jiang, L. Zhang, and L. Marcenaro, "Let there Be a beam: highlights from the 2020 IEEE five-minute Video Clip contest," *IEEE Signal Processing Magazine*, vol. 37, no. 5, pp. 157–162, 2020.

[6] F. Boccardi, R. W. Heath, A. Lozano, T. L. Marzetta, and P. Popovski, "Five disruptive technology directions for 5G," *IEEE Communications Magazine*, vol. 52, no. 2, pp. 74–80, 2014.

[7] W. Roh, J. Seol, J. Park et al., "Millimeter-wave beamforming as an enabling technology for 5G cellular communications: theoretical feasibility and prototype results," *IEEE Communications Magazine*, vol. 52, no. 2, pp. 106–113, 2014.

[8] T. L. Marzetta, E. G. Larsson, H. Yang, and H. Q. Ngo, *Fundamentals of Massive MIMO*, Cambridge Univ. Press, Cambridge, U.K, 2016.

[9] K. V. Mishra, M. R. Bhavani Shankar, V. Koivunen, B. Ottersten, and S. A. Vorobyov, "Toward millimeter-wave joint radar communications: a signal processing perspective," *IEEE Signal Processing Magazine*, vol. 36, no. 5, pp. 100–114, September 2019.

[10] Y. Cui, F. Liu, X. Jing, and J. Mu, "Integrating sensing and communications for ubiquitous IoT: applications, trends, and challenges," *IEEE Network*, vol. 35, no. 5, pp. 158–167, 2021.

[11] W. Liu, D. C. McLernon, A. W. H. Khong, and L. Yu, "Recent advances in design and signal processing for antenna arrays," *International Journal of Antennas and Propagation*, vol. 2, 2016.

[12] M. I. Abbasi, M. Y. Ismail, and M. R. Kamarudin, "Development of a pin diode-based beam-switching single-layer reflectarray antenna," *International Journal of Antennas and Propagation*, vol. 2020, Article ID 8891759, 9 pages, 2020.

[13] Z. K. Chen, T. Li, D. L. Peng, and K. Du, "Two-dimensional beampattern synthesis for polarized smart antenna array and its sparse array optimization," *International Journal of Antennas and Propagation*, vol. 2020, Article ID 2196049, 13 pages, 2020.

[14] X. Li and B. H. Wang, "Thinned virtual array for Cramer Rao bound optimization in MIMO radar," *International Journal of Antennas and Propagation*, vol. 2021, Article ID 1408498, 13 pages, 2021.

[15] C. Wu and J. Elangage, "Nonuniformly spaced array with the direct data domain method for 2D angle-of-arrival measurement in electronic support measures application from 6 to 18 GHz," *International Journal of Antennas and Propagation*, vol. 2020, Article ID 9651650, 23 pages, 2020.

[16] Z. Q. Wang, Y. J. Li, J. N. Shi et al., "Spread sea clutter suppression in HF hybrid sky-surface wave radars based on general parameterized time-frequency analysis," *International Journal of Antennas and Propagation*, vol. 2020, Article ID 7627521, 12 pages, 2020.

[17] K. K. Yang, S. Hong, Q. Zhu, and Y. H. Ye, "Maximum likelihood angle-range estimation for monostatic FDA-MIMO radar with extended range ambiguity using sub-arrays," *International Journal of Antennas and Propagation*, vol. 2020, Article ID 4601208, 10 pages, 2020.