Call for Papers

Special Topic: Intelligent and Reconfigurable Antenna Systems in the Near Field

With the rapid deployment and continuing evolution of fifth-generation (5G) wireless networks, global research efforts toward sixth-generation (6G) communications have been extensively initiated. To satisfy the stringent requirements of future wireless networks, including ultra-high data rates, extremely low latency, massive connectivity, and high-precision sensing, wireless systems are evolving toward millimeter-wave and terahertz frequencies, as well as extremely large-scale antenna architectures. The combination of high-frequency transmission and electrically large apertures significantly extends the Rayleigh distance, making near-field propagation increasingly more common in future wireless networks.

In contrast to conventional far-field propagation based on planar waves, near-field transmission is characterized by spherical wavefronts, distance-dependent phase variations, and spatially non-stationary channels. These features add the distance dimension to the traditional angular dimension, allowing users in similar directions but at different distances to be identified and served at the same time. Near-field propagation therefore provides new opportunities for spatial multiplexing, multi-user access, interference suppression, physical-layer security, and three-dimensional beam focusing. Moreover, different antenna elements can provide distinct spatial observations and serve as distributed positioning references, thereby improving the accuracy of localization, imaging, and environmental sensing. Such advantages make near-field technologies a promising foundation for integrated communication, sensing, positioning, and wireless power transfer in 6G networks. Nevertheless, the transition from far-field planar-wave transmission to near-field spherical-wave transmission poses fundamental challenges to conventional antenna architectures and signal processing methods. Accurate channel models are required to characterize spherical-wave propagation, spatial non-stationarity, visibility regions, mutual coupling, and wideband effects. Meanwhile, the large number of antenna elements and configurable parameters may result in excessive training overhead and computational complexity in channel estimation, beam training, and beamforming design.

Intelligent and reconfigurable antenna systems offer a practical way to address these challenges and make better use of near-field propagation. Representative technologies include reconfigurable intelligent surfaces, extremely large-scale MIMO, holographic MIMO, dynamic metasurface antennas, movable antennas, fluid antennas, and cell-free massive antenna arrays. By adjusting antenna positions, radiation patterns, electromagnetic responses, and aperture distributions, these systems can adapt their beams and propagation environments according to user locations, channel conditions, and service requirements. When combined with artificial intelligence, they can further support low-overhead channel reconstruction, beam prediction, adaptive antenna configuration, and real-time transmission optimization.

This Special Topic is devoted to recent advances in the theories, technologies, architectures, algorithms, and experimental demonstrations of intelligent and reconfigurable antenna systems in the near field. Topics of interest include, but are not limited to:

- Near-field channel measurement and modeling for IRA systems
- Antenna configuration optimization for near-field IRA systems
- Channel estimation and CSI acquisition for near-field IRA systems
- Near-field sensing and imaging with IRAs
- Performance analysis for near-field IRA wireless systems
- Near-field integrated sensing and communications with IRAs
- Resource allocation for near-field IRA systems
- Digital twin for near-field IRA systems
- Machine learning for IRA-assisted near-field communications
- Advanced near-field localization with IRAs
- Reconfigurable intelligent surface (RIS)-assisted near-field wireless communications
- Fluid antenna for near-field communications
- Movable antennas for near-field communications
- Near-field communications with holographic MIMO
- Experimental demonstrations and field tests of near-field IRA systems
- Dynamic metasurface antennas for near-field communications

Submission

The papers should be edited in the SCIS template, and should be submitted online through the manuscript submission system of the *SCIENCE CHINA Information Sciences*. The submission website is: https://mc03.manuscriptcentral.com/scis. You should choose **"Special Topic: Intelligent and Reconfigurable Antenna Systems in the Near Field".** Information and guidelines on preparation of manuscripts are available on the journal website: http://scis.scichina.com.

Important Dates

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