



Empowering Dense Smart City Networks with Intelligent Antenna Systems

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Yellow Zone, Yeung Kin Man Academic
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ABSTRACT

Future smart cities will inevitably evolve toward ultra-dense wireless network architectures. Driven by digital transformation, typical communication scenarios such as urban canyons, smart factories, and transportation hubs will face massive dense terminal access demands, while exhibiting highly dynamic, heavily obstructed, strongly interfered, and heterogeneous network characteristics. Specifically, on the one hand, complex environments will contain denser multipath clusters, and moving objects will cause frequent blockages, making deep fading, rapid phase drift, and link instability more prominent. On the other hand, as the number of simultaneously active users and terminals over the same time-frequency resources continues to increase, scheduling difficulty, access collisions, and link-quality differentiation will be further aggravated. Intelligent antennas system, also known as Fluid Antenna Systems (FAS), represent an important technical direction for addressing future complex wireless environments. In ultra-dense, multi-user, and highly dynamic communication scenarios, FAS can introduce additional spatial degrees of freedom through reconfigurable ports or flexible excitation positions. This enables the system to dynamically select, from multiple candidate ports, spatial sampling points with stronger desired signals and weaker interference coupling, without significantly increasing hardware cost or the number of physical antenna elements. As a result, FAS can provide more flexible, low-complexity, and environment-adaptive wireless access capabilities for ultra-dense smart city networks. This report will first introduce the basic operating mechanisms of existing intelligent antenna technologies, and then discuss their theoretical research foundations and typical application scenarios in ultra-dense wireless networks.

BIOGRAPHY

Prof Yongxu Zhu is a Full Professor and Ph.D. Supervisor, honored as a National High-Level Young Talent (Overseas) and a Jiangsu Specially-Appointed Professor. She received her Ph.D. degree from University College London (UCL) in 2017. Subsequently, she held positions as a Postdoctoral Research Fellow at Loughborough University, a Senior Lecturer in Computer Science at London South Bank University, and an Assistant Professor in Engineering at the University of Warwick (ranked 61st globally by QS). Her research focuses on future mobile communication networks, swarm game networks, fluid antenna systems, cell-free networks, and stochastic geometric network theory. She has published over 70 papers in prestigious journals and conferences, including IEEE Transactions. She has led numerous research projects funded by the National Natural Science Foundation of China (including the Overseas Outstanding Youth Program), the Royal Society, the British Council, and the University of Warwick, among others. Her work has received wide recognition from leading scholars and been adopted by multiple institutions and companies. Prof Yongxu serves as an editor for top journals such as China Communications, Science China Information Sciences, IEEE Transactions on Wireless Communications, IEEE Wireless Communications Letters, and IEEE Systems Journal. She has also organized various international conferences, including ICC, WCNC, and VTC. Her achievements include the Best Paper Award at IEEE Globecom 2024, the First Youth Science and Technology Award of the China Communications Society (2024), the Zijin Young Scholar Award, the Best Editor Award of IEEE Wireless Communications Letters, the N2WOMEN "Rising Star" (one of ten globally), and being named among the "Brilliant and Inspiring Women in 6G" for three consecutive years (2023–2025).

All are welcome!



In case of questions, please contact Prof. FANG Yuguang at my.fang@cityu.edu.hk, or visit the CS Departmental Seminar Web at <https://www.cs.cityu.edu.hk/events/cs-seminars/recent-cs-colloquiums>.

