

ICICN2026 Track 2

Basic Information:

专栏题目

Title

中文：面向 6G 通信的灵活天线技术

英文：Flexible Antenna Techniques Towards 6G Communications

专栏介绍和征稿主题

Introduction and topics

中文：全球第六代移动通信系统（Sixth-Generation Mobile Communication System, 6G）竞争已进入关键阶段，6G 旨在实现物理世界与数字世界深度融合，支撑各类大数据密集型应用场景。此类场景对超高频谱效率、超低时延、超高可靠性及全域无缝覆盖均提出严苛要求。因此，作为 6G 物理层核心技术—灵活天线技术，尤其是多输入多输出（Multiple-Input-Multiple-Output, MIMO）技术及其相关解决方案，亟需突破传统天线技术瓶颈。

6G 全域智能、无缝互联的发展愿景，对网络架构革新提出了迫切需求。而传统固定天线与常规 MIMO 技术存在固有短板：动态环境适配能力差、部署成本高昂、信号覆盖能力有限。在此背景下，推动 MIMO 技术与智能超表面（Reconfigurable Intelligent Surfaces, RIS）、可移动天线（Movable Antennas, MA）、流体天线系统（Fluid Antenna Systems, FAS）、夹式天线系统（Pinching-Antenna Systems, PASS）深度融合，已成为当前首要研究任务。

为攻克上述技术难题，以 MIMO 为核心、具备自适应、高能效、环境自适应特性的灵活天线技术不可或缺。将 MIMO 与各具独特自适应特性的 RIS、MA、FAS、PASS 技术相结合，可构建高性能通信体系。借助人工智能与机器学习开展相关系统优化设计，已成为国际移动通信 2030（IMT-2030，即 6G）重点研究方向。

本专栏征稿主题包括但不限于：

1. 面向 6G 的 NOMA 与灵活 MIMO 天线联合传输机制及性能优化
2. AI 驱动的自适应灵活天线系统设计与智能波束成形算法
3. RIS 与可移动天线（MA）融合的 6G 覆盖增强技术
4. 流体天线系统（FAS）与夹式天线系统（PASS）的 MIMO 集成架构
5. 面向大规模连接的灵活天线与多址资源分配理论
6. 基于机器学习的 6G 灵活天线信道估计与动态环境适配方法
7. 高能效灵活天线在 6G 近场通信与卫星波束跳变中的应用

英文：The global race for Sixth-Generation Mobile Communication System (6G) has entered a critical phase, aiming to integrate the physical and digital worlds and support diverse data-intensive scenarios. These scenarios demand ultra-high spectral efficiency, ultra-low latency, extreme reliability, and global coverage. Thus, advanced flexible antenna technologies—especially Multiple-Input-Multiple-Output (MIMO) and complementary solutions as the 6G physical layer core, are urgent to break traditional antenna limitations.

The pursuit of 6G “ubiquitous intelligence and seamless connection” vision requires innovative network configurations. However, traditional fixed antennas and conventional MIMO face inherent bottlenecks: poor adaptability to dynamic environments, high deployment costs, and limited coverage capability. These make integrating MIMO with Reconfigurable Intelligent Surfaces (RIS), Movable Antennas (MA), Fluid Antenna Systems (FAS), and Pinching Antenna Systems (PASS) an urgent priority.

To address these challenges, MIMO centered flexible antenna techniques (adaptive, energy-efficient, environment-adaptable) are essential. Integrating MIMO with RIS, MA, FAS, and PASS, each with unique adaptive capabilities forms a robust system. Artificial Intelligence/Machine Learning aided design for these systems has become a key IMT-2030 (6G) research direction.

Topics of interest for this Special Session include but are not limited to:

1. Joint transmission mechanism and performance optimization of NOMA and flexible MIMO antennas for 6G
2. AI-driven design of adaptive flexible antenna systems and intelligent beamforming algorithms
3. 6G coverage enhancement technology based on integration of RIS and movable antennas (MA)
4. MIMO integrated architecture of fluid antenna systems (FAS) and pinching antenna systems (PASS)
5. Resource allocation theory of flexible antennas and multiple access for massive connections

6. Machine learning-based channel estimation and dynamic environment adaptation for 6G flexible antennas
7. Application of energy-efficient flexible antennas in 6G near-field communications and satellite beam hopping

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Organizer's Brief Biography

中文：岳新伟（IEEE 会员），2018 年于北京航空航天大学取得信息与通信工程博士学位。2019—2024 年任北京信息科技大学信息与通信工程学院副教授，2024 年 7 月起任该院教授。主要研究方向：6G 通信网络、非正交多址接入、智能超表面、物理层安全、近场通信、卫星通信波束跳变。

2024 年荣获第十七届北京青年优秀科技论文奖。先后于 2019 年、2022 年、2024 年获评 IEEE Transactions on Communications、IEEE Communication Letters、IEEE Wireless Communications Letters 杰出审稿人。2023-2025 连续三年入选全球前 2% 顶尖科学家榜单。目前担任 IEEE Systems Journal、IEEE Open Journal of the Communications Society、Journal of Information and Intelligence、KSII Transactions on Internet and Information Systems、IET Networks 等国内外期刊编委，并担任 IEEE VTC 2023-Spring、IEEE ICC 2025、IEEE WCNC 2025 会议技术程序委员会委员。

英文：Xinwei Yue (Member, IEEE) received the Ph.D. degree in communication and information system from Beihang University, Beijing, China, in 2018. He has been a Full Professor with the College of Information and Communication Engineering, Beijing Information Science and Technology University, Beijing, since July 2024, where he was an Associate Professor from 2019 to 2024. His research interests include 6G networks, nonorthogonal multiple access, reconfigurable intelligent surface, physical layer security, near field communications, and satellite communication beam hooping.

He received the 17th Beijing Youth Excellent Science and Technology Paper Award in 2024. He received the Exemplary Reviewer of the IEEE Wireless Communications Letters, the IEEE Communication Letters and the IEEE Transactions on Communications in 2024, 2022, and 2019, respectively. He was list as one of the World Top 2% Scientists in 2023/2024/2025. He is serving as an Editor for IEEE Systems Journal, IEEE Open Journal of the Communications Society, Journal of Information and Intelligence, KSII Transactions on Internet and Information Systems, IET Networks, a TPC Member for IEEE VTC 2023-Spring, IEEE ICC 2025, and IEEE WCNC 2025.

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Organizer's Brief Biography

中文：孙贺于 2016 年获得南京航空航天大学学士学位，2022 年获得北京航空航天大学博士学位。2022 年至 2026 年在新加坡国立大学电子与计算机工程系担任 Research Fellow。现为北京航空航天大学电子信息工程学院副教授。研究方向主要包括无线信道建模、无线电地图、智能表面、优化技术以及信道编码。曾获 2022 年 IEEE Communications Letters 杰出审稿人称号，并担任多个 IEEE 国际会议的技术程序委员会（TPC）委员。

英文：He Sun (Member, IEEE) received the B.S. degree from Nanjing University of Aeronautics and Astronautics (NUAA) in 2016, and the Ph.D. degree from Beihang University in 2022. From 2022 to 2026, he was a Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore. He is currently an Associate Professor with the School of Electronic and Information Engineering, Beihang University. His recent research interests include wireless channel modeling, radio mapping, intelligent surface, optimization techniques, and channel coding. He was a recipient of the Exemplary Reviewer of the IEEE Communications Letters in 2022. He has served as a TPC member for many IEEE conferences.



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英文：Xuyang Zhang (Graduate Student Member, IEEE) received the B.S. degree and M.S. degree in communications engineering in 2021 and 2024, from the Beijing Information Science and Technology University, Beijing, China, where he is currently working toward the Ph.D. degree in the School of Cyberspace Science and Technology, Beijing Institute of Technology, Beijing. His research interests include satellite secure communication, covert communications, and beam hopping.