國立陽明交通大學 電信工程研究所 系統組論文研討

Partitioning-Based RIS Phase Configuration Schemes for SSK Systems with Passive Beamforming

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Abstract

Reconfigurable intelligent surface (RIS)-assisted space shift keying with passive beamforming (RIS-SSK-PB) provides high energy efficiency while allowing RIS phase updates at the channel coherence time rather than the symbol rate, thereby significantly reducing system overhead and hardware complexity. The core idea of the proposed framework formulates the phase-configuration problem as a channel-dependent RIS partitioning problem, where RIS elements are jointly partitioned and phase-optimized to shape the received noiseless signals of different SSK modes toward predefined multi-level constellation points, enhancing signal separability and detection performance. The proposed RIS-partitioning schemes are formulated as mixed-integer linear programming (MILP) optimization problems, and four algorithms based on linear programming relaxation are proposed to achieve near-optimal performance with substantially reduced complexity. Numerical results demonstrate that the proposed schemes significantly outperform benchmark methods while maintaining practical implementation efficiency.

Biography

Prof. Kelvin Kuang-Chi Lee received the M.S. degree from the University of Southern California (USC), USA, in 1991, and the Ph.D. degree in Electrical Engineering from the University of California at Los Angeles (UCLA), USA, in 2010.

From 1992 to 2002, he worked in the semiconductor and communication industries as a Project Lead, where he supervised the development of mixed-signal communication integrated circuits (ICs). From 2010 to 2014, he joined Broadcom Inc., Taiwan, as a Principal Scientist, where he was responsible for advancing IEEE 802.11 a/b/g/n WLAN technologies and developing high-performance communication solutions. With extensive experience spanning both industry and academia, he has established a unique career in wireless communications, digital signal processing (DSP), and integrated circuit design.

Prof. Lee is currently an Associate Professor in the Department of Electrical and Computer Engineering at Tamkang University, Taiwan. His current research focuses on emerging wireless communication technologies, including 5G/6G communication systems, Reconfigurable Intelligent Surfaces (RIS), Orthogonal Time Frequency Space (OTFS) modulation, DSP, and digital System-on-Chip (SoC) design.