National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: User Selection in Energy-Constrained Wireless-Powered CNOMA over Nakagami-m Channels
Speaker	: Samparna Parida (Rollno : 518ec1009)
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Venue	: Seminar Room, Room No. EC-303, Department of ECE (Electrical Science Building)
Date and Time	: 22 Jul 2025 (11:00 A.M.)

Abstract

: Cooperative Non-Orthogonal Multiple Access (CNOMA) integrated with wireless energy harvesting is a key enabler for future wireless networks such as 6G and large-scale IoT. While CNOMA improves spectral efficiency through power-domain multiplexing, energy harvesting techniques like Simultaneous wireless information and power transfer (SWIPT) and wireless power transfer (WPT) enable self-sustainable communication for low power wireless devices. SWIPT allows simultaneous data and energy transfer, whereas WPT uses dedicated RF sources for power delivery. However, combining CNOMA with energy harvesting introduces challenges such as degraded performance and increased complexity under energy constraints. This thesis addresses these by finding low-complexity yet energy-efficient user selection strategies for both SWIPT- and WPT-assisted CNOMA systems. A comprehensive evaluation of user selection schemes along with relaying techniques including amplify forward (AF), decode forward (DF), and hybrid (AF/DF) protocols under Nakagami-m fading, reveals that although SWIPT supports sustainability, it degrades system performance. Among the user selection schemes investigated, the Partial Channel State Information (P-CSI) based scheme and among the relaying techniques, the DF relaying, proves to be most effective, significantly enhancing outage and throughput performance while maintaining low complexity. Closed-form expressions for key performance metrics are derived, confirming that partial channel state information (P-CSI) selection scheme consistently outperforms conventional schemes like max-min, min-max, reactive relay selection (RRS), and random selection scheme especially with multiple near users. In WPT-assisted scenarios, P-CSI scheme further demonstrates much improvement in outage performance than SWIPT-assisted CNOMA. A comparative analysis shows that WPT generally offers better outage and throughput, while SWIPT excels in energy efficiency. An adaptive user selection algorithm is proposed to dynamically optimize system performance across varying SNR ranges, energy harvesting protocols and required QoS.

The thesis presents a complete framework for enhancing the performance of energy-constrained wireless-powered CNOMA via efficient user selection under Nakagami-m fading, contributing to the design of sustainable and practical 6G and IoT communication architectures.