INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

In the thesis, performance analysis of three-node decode-and-forward (DF) relay systems comprising a single source node, a single relay node and a single destination node is presented. Each node is equipped with a single antenna and operate in half-duplex mode. The performance analysis is presented for three system types i) conventional DF relay system, ii) wireless powered (WP) relay system with energy harvesting (EH) at the relay node, and iii) WP relay system with EH at the source node. In the first system, transmitting nodes are considered to be conventionally powered by a continuous source of energy with sufficient supply to support end-to-end communication. However, in the other two systems, one of the communicating nodes is energy-constrained and relies on the harvested energy for data transmission. The energy is harvested using radio frequency (RF) signal transmitted by another node in the system. In the second system, we consider that relay node is energy-constrained and wirelessly powered by RF signal transmitted by the source node. RF signal radiated by the relay node powers the energy-constrained source node in the third system. Further, we consider channels are modeled using generalized distribution which characterizes different fading environments. The first system experiences κ-μ fading and η-μ fading, the second system is under Nakagami-m fading, and the third system is κ-μ shadowed faded. In the first two system, we consider data is M-ary phase-shift keying (M-PSK) modulated with coherent detection. M-PSK with coherent detection and orthogonal M-ary frequency-shift keying (M-FSK) with noncoherent detection are considered for the third system. Analytical average symbol error rate (SER) expressions and their high SNR asymptotic approximations for the three systems are derived. Asymptotic results are used for identifying diversity order and optimization of i) transmission power at the nodes in the first system, ii) energy allocation, transmission time, and transmission power in different slots of the second system, and iii) relay location in the third system. Numerical results are presented to analyze the dependency of the systems' performance on channel conditions, modulation order, and relay location. Through numerical results we observed that the optimal relay lies i) between source and destination nodes with inclination toward the destination node in the first system, ii) near source node in the second system, and iii) between source and destination nodes with inclination toward the node with poor link quality.