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AWGN and rayleigh fading behavior of the wireless decode-and-forward relay channel with arbitrary time and power allocation (Article)

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Abstract

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Relying has in use for decades to tackle some of the challenges of wireless communication such as extending transmitting distance, transmitting over rough terrains. Diversity achieved through relaying is also a means to combat the random behavior of fading channels. In this work, effect of time and power allocation on relay performance is studied. The channel considered is the three-node channel with half-duplex constraint on the relay. The relaying technique assumed is decode-and-forward. Mutual information is used as the criteria to measure channel performance. There is half-duplex constraint and a total transmission power constraint on the relay source node and the relay node. A model is established to analyze the mutual information as a function of time allocation and power allocation in the case of AWGN regime. The model is extended to the Rayleigh fading scenario. In both AWGN and Rayleigh fading, results showed that the importance of relaying is more apparent when more resources are allocated to the relay. It was also shown that quality of the source to destination link has direct impact on the decision to relay or not to relay. Relatively good source to destination channel makes relaying less useful. The opposite is true for the other two links, namely the source to relay channel and the relay to destination channel. When these two channels are good, relaying becomes advantageous. When applied to cellular systems, we concluded that relaying is more beneficial to battery-operated mobile nodes than to base stations.

Author keywords

Decode-and-forward | Mutual information | Power allocation | Relaying | Three-node channel | Time allocation

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