Optimal-Switching Adaptive Modulation for Multiuser Relay Networks with Feedback Delays
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ABSTRACT

The performance of optimal switching adaptive modulation for multiuser amplify-and-forward (AF) relay networks over Nakagami-m fading channel is studied. Moreover, we consider two types of communication: i) relay-assisted communication (RAC): the source transmits its message to best user via relay path, ii) selective communication (SC): the source decides whether to forward the source message to the best user via relay path or direct path by comparing the end-to-end instantaneous signal-to-noise ratio (SNR) at the best user, which is independent of modulation scheme. Specifically, multiuser diversity and adaptive discrete-rate five-mode M-ary quadrature amplitude modulation (M-QAM) with constant transmit power is employed with fixed and optimal switching thresholds. The optimization criterion for switching thresholds is the maximization of spectral efficiency subject to target bit-error-rate. In particular, the detrimental effect of feedback delays in multiuser opportunistic scheduling (which exploits multiuser diversity) and adaptive modulation is quantified. To this end, an exact and an upper bound of the end-to-end SNRs are obtained and used to derive the cumulative distribution function and probability density function for each case. Moreover, exact outage probabilities, and lower bounds for the outage probabilities and average bit error rates, and the average spectral efficiencies are derived in closed-form. Further, we also present the high SNR approximations for outage probabilities and BERs. We observe that, for a particular spectral efficiency, adaptive five-mode M-QAM with optimal switching outperforms fixed switching and provides approximately 2 dB and 2.5 dB gain in average SNR for RAC and SC, respectively. Monte-Carlo simulations are performed to validate the analytical results.

REFERENCES


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