

Accurate Closed-Form Approximations for the BER of Multi-Branch Amplify-and-Forward Cooperative Systems with MRC in Rayleigh Fading Channels

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Abstract: Relay-based cooperative systems have recently attracted significant attention since they enable exploiting the inherent spatial diversity of wireless networks with single antenna terminals. In this paper, the authors address the error performance of a cooperative diversity network consisting of a source, a destination, and multiple dual-hop amplify-and-forward (AF) relays in Rayleigh fading channels, in which the source broadcasts the signal to the relays in the first time slot and the relays simultaneously forward signals to the destination in the second time slot. Analytically studying the error performance of multiple dual-hop AF cooperative networks with maximal ratio combining (MRC) receivers at the destination and deriving closed-form expressions has always been a difficult task. Considering an L-Relay nodes AF cooperative network in Rayleigh fading channels employing MRC, closed-form approximate expressions are derived for the bit error rate (BER) of a class of coherent modulation techniques that are easy to calculate, thus circumventing the computational inefficiency of the exact formulation. Exact results obtained using numerical integration are provided to validate the tightness of the proposed expressions. In addition, a slight modification for the amplification gain at the relay-node is proposed, which showed an improvement in the effective signal-to-noise ratio at the destination node.