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Performance Analysis of Cooperative NOMA for Different Power Allocation Strategies

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Abstract: Cooperative Non-Orthogonal Multiple Access (C-NOMA) is a promising approach for 5G and beyond communication networks. Users will benefit from the full bandwidth of the channel without time constraints. NOMA's features are incomplete without efficient power allocation that ensures power distribution among users fairly. Integrating power management (allocation) with Cooperative-NOMA (C-NOMA) may improve the system metrics. In addition, a physical layer security (PLS) is added to make the process of sending and receiving safe, and the system works in an integrated manner, preventing any interrupting or eavesdropping inside or outside the network. This paper demonstrates the user and channel performance of C-NOMA with Amplify-and-forward (AF) and Decode-and-forward (DF) approaches. The analysis is performed by varying the power allocation techniques to derive the best system configurations. The simulation results confirmed the analytic findings and showed that the proposed system outperforms orthogonal multiple access (OMA), conventional NOMA, and conventional cooperative NOMA, enhancing the performance metrics in terms of throughput, sum rate, and outage probability. The bit-error-rate (BER) of the far user can be identical to that of the near user if power allocation is properly set. All techniques excelled except for the fixed power allocation, which had the same BER. The Channel capacity and outage probability were also considered. A slight variation in the channel capacity in all the experiments for different numbers of users was found. The generalized power allocation for AF and DF models had the optimum channel capacity close to 14 bps/Hz. Moreover, far users always had a higher outage probability than near users and channels, and generalized power allocation was the highest outage probability technique when the transmit power was close to (-4 dB).

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