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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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Table of Contents Journal Of Computing Performance Analysis Cooperative

1. Understanding the eBook Journal Of Computing Performance Analysis Cooperative
 - The Rise of Digital Reading Journal Of Computing Performance Analysis Cooperative
 - Advantages of eBooks Over Traditional Books
2. Identifying Journal Of Computing Performance Analysis Cooperative
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Journal Of Computing Performance Analysis Cooperative
 - User-Friendly Interface
4. Exploring eBook Recommendations from Journal Of Computing Performance Analysis Cooperative
 - Personalized Recommendations
 - Journal Of Computing Performance Analysis Cooperative User Reviews and Ratings
 - Journal Of Computing Performance Analysis Cooperative and Bestseller Lists
5. Accessing Journal Of Computing Performance Analysis Cooperative Free and Paid eBooks

- Journal Of Computing Performance Analysis Cooperative Public Domain eBooks
 - Journal Of Computing Performance Analysis Cooperative eBook Subscription Services
 - Journal Of Computing Performance Analysis Cooperative Budget-Friendly Options
6. Navigating Journal Of Computing Performance Analysis Cooperative eBook Formats
 - ePub, PDF, MOBI, and More
 - Journal Of Computing Performance Analysis Cooperative Compatibility with Devices
 - Journal Of Computing Performance Analysis Cooperative Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Journal Of Computing Performance Analysis Cooperative
 - Highlighting and Note-Taking Journal Of Computing Performance Analysis Cooperative
 - Interactive Elements Journal Of Computing Performance Analysis Cooperative
 8. Staying Engaged with Journal Of Computing Performance Analysis Cooperative
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Journal Of Computing Performance Analysis Cooperative
 9. Balancing eBooks and Physical Books Journal Of Computing Performance Analysis Cooperative
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Journal Of Computing Performance Analysis Cooperative
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Journal Of Computing Performance Analysis Cooperative
 - Setting Reading Goals Journal Of Computing Performance Analysis Cooperative
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Journal Of Computing Performance Analysis Cooperative
 - Fact-Checking eBook Content of Journal Of Computing Performance Analysis Cooperative
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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