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# A novel resource optimization scheme for multi-cell OFDMA relay network

**Key words:** Intra-cell communication, Two-way relay, Subcarrier assignment, Subcarrier pairing

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# Motivation

- In cellular networks, users communicate with each other through their respective base stations (BSs). Conventionally, users are assumed to be in different cells. BSs serve as decode-and-forward (DF) relay nodes to users. In addition to this type of conventional user, we recognize that there are scenarios that users who want to communicate with each other are located in the same cell. This gives rise to the scenario of intra-cell communication.
- Many existing works focus on individual uplink or downlink resource allocation (RA) in cellular networks or multiple relay stations (RSs) deployed in the cellular networks, which will increase the complexity and extra investment.

# Main idea

- We make the BS serve not only as a DF relay but also as a TW relay to assist cellular network communication, and the uplink and downlink transmission strategy is jointly designed to improve system performance.
- We consider a multi-cell orthogonal frequency division multiple access (OFDMA) network that comprises these two types of users.

# Method

1. Introduce the proposed communication model. We jointly optimize subcarrier assignment, subcarrier pairing, and power allocation to maximize the weighted sum rate.
2. We consider the resource allocation problem at BSs when the end users' power is fixed. We solve the problem approximately through Lagrange dual decomposition.
3. For comparison, we present results on two suboptimal schemes and one conventional transmission scheme. Simulation results show that the proposed schemes outperform other existing schemes.

# Major results

- Simulation results show that the proposed schemes outperform other existing schemes.

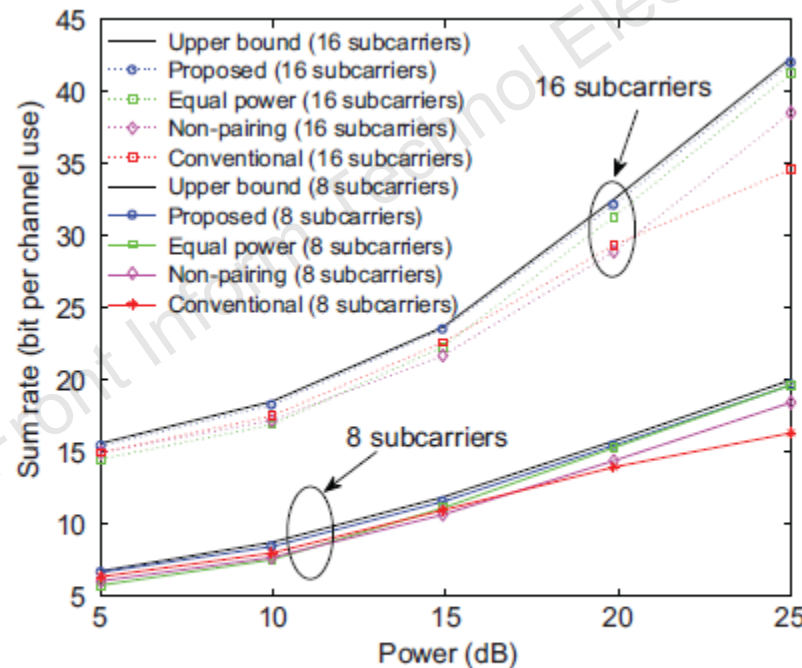


Fig. 2 Sum rate versus power constraint with equal weights

# Conclusions

- Inspired by multi-way relay and intra-cell communication, we proposed that the BS can be considered as a TW DF relay to assist cellular communication.
- Joint uplink and downlink resource optimization for the OFDMA system was investigated. These problems led to a non-convex optimization problem with high complexity. Since they were intractable, we transformed these problems into less complicated ones, and proposed an efficient algorithm.
- Numerical results showed that BS serving as a TW relay improves intra-cell communication, especially when the power constraint is in the high dB region.