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Hybrid full-/half-duplex cellular networks: user admission and power control

Key words: Full-duplex; Half-duplex; User admission; Power control

Corresponding author: Cai-jun ZHONG
E-mail: caijunzhong@zju.edu.cn
 ORCID: http://orcid.org/0000-0002-9960-7800

Motivations

1. The in-band full-duplex (FD) technique has appeared as a promising technology for spectral efficiency improvement.

2. The state-of-the-art cancellation method could achieve more than 110 dB reduction of SI, paving the way for practical implementation of the FD technique.

3. Due to severe interference, the performance of FD mode may not always be superior to HD mode.

4. The hybrid FD/HD mode has been proposed, where BS can work either in FD or HD mode depending on the operating environment.

Main ideas

1. We considers a single-cell network with a hybrid full-/ half-duplex base station. We tackle the issue of user admission and power control to simultaneously maximize the user admission number and minimize the total transmit power when guaranteeing the quality-of-service requirement of individual users.

2. We formulate a 0–1 integer programming problem for the joint-user admission and power allocation problem. A low-complexity algorithm is proposed by introducing the novel concept of adding dummy users.

Methods

1. We present a simple criterion to measure the feasibility of pairing any two uplink and downlink users based on the average channel gains. Then, it is used to define the admissible pairs for the optimization problem.
2. We propose a novel ‘dummy user’ assisted strategy, and transform the original optimization problem into a joint-user admission and power control problem, which can be solved efficiently by the Kuhn-Munkres (K-M) algorithm.

Major results

The proposed Algorithm 1 with low complexity attains performance identical to the BnB algorithm with high complexity.

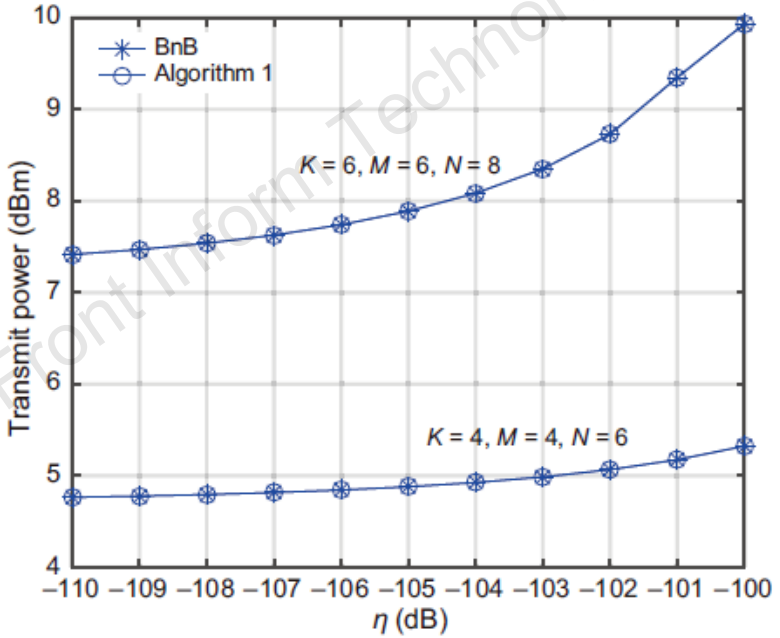

Fig. 4 Performance comparison: BnB (branch and bound) vs. Algorithm 1

Major results (Cont'd)

More users can be admitted into the system with the increase of channel number.

The proposed algorithm always attains better performance, compared with the random pairing scheme.

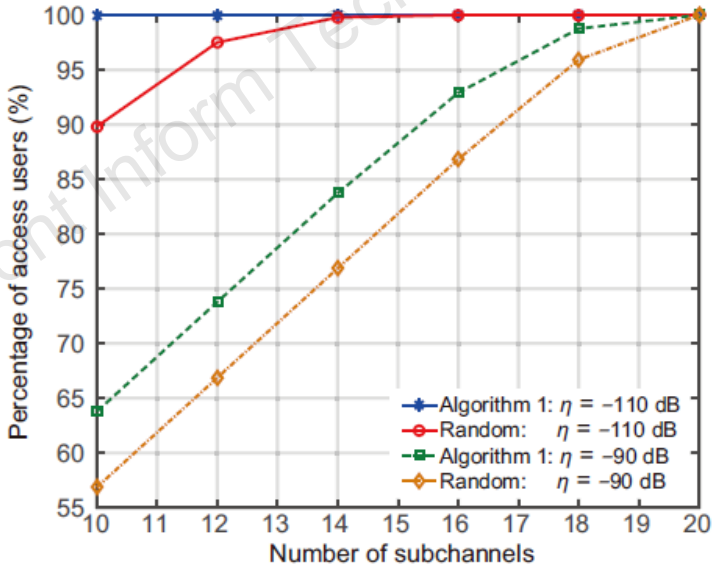

Fig. 5 Percentage of admitted users with different numbers of subchannels

Major results (Cont'd)

1. The total transmit power decreases when the number of channels increases.
2. When η is large, more power should be used to compensate for SI in the uplink and downlink.

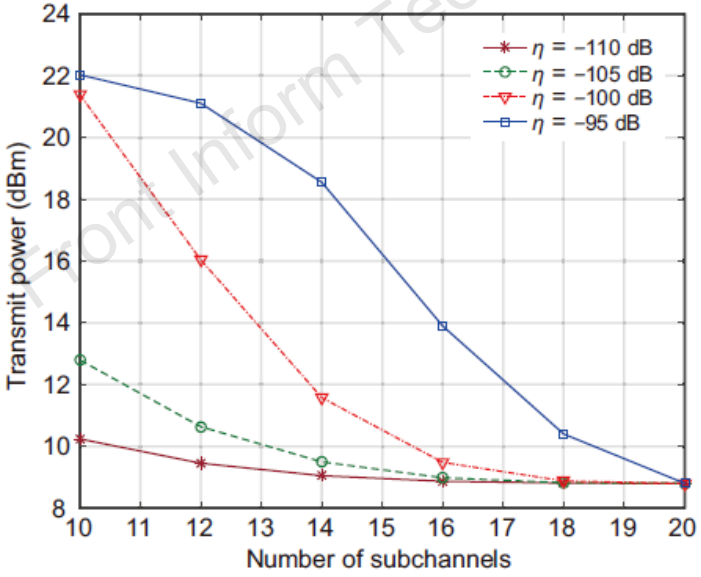

Fig. 7 Impact of η on the total transmit power

Conclusions

1. We have studied the joint-user admission and power control problem in a single cell hybrid FD/HD network.

2. By introducing the concept of dummy users, the original 0–1 integer programming problem was transformed into a standard assignment problem, which was then solved efficiently.

3. Numerical results suggests that the proposed pairing scheme attains much better performance, compared with random pairing.