Cell-edge Classification for 2-step Interference Coordination in Multi-cell Distributed MU-MIMO Ultra-dense RAN

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1. Introduction

Recently, we proposed a restricted color number (RCN) [1] based graph coloring algorithm (GCA) for inter-cluster interference coordination in a single-cell distributed MU-MIMO. In a multi-cell distributed MU-MIMO, if the RCN-GCA is applied to each cell independently, the color collision may happen frequently due to the lack of inter-cell coordination and offsets the performance improvement achievable by RCN-GCA. In order to coordinate the inter-cluster interference and inter-cell interference simultaneously, we also proposed a 2-step GCA for multicell ultra-dense RAN [1]. The main idea is to divide users in each cell into two groups (cell-edge and cell-center) and to apply GCA separately on these two groups. The first step is to apply GCA in multi-cell level to assign different colors to different cell-edge users. After that, for the given cell-edge color, the RCN-GCA is applied inside each cell to coordinate the inter-cluster interference. In this paper, we deal with the cell-edge classification method in multi-cell distributed MU-MIMO. We consider user-wise and cluster-wise cell-edge classification methods and compare the achievable link capacity in a multi-cell distributed MU-MIMO.

2. Simulation Results

2-step graph coloring algorithm jointly used with the considered cell-edge classification method is shown in Fig.1, and the simulation result for downlink sum capacity is shown in Fig.2. The cluster-wise cell-edge classification provides higher link capacity than the user-wise cell-edge classification. In the case of user-wise classification, certain number of users are selected as cell-edge users based on their location or interference level, and these users choose their nearest antenna via user-antenna association. Sparse distribution of cell-edge users and antennas affects adversely the inner-cell users' clustering process. This is a possible reason why user-wise classification performance is degraded. On the other hand, in the case of cluster-wise classification, clusters are formed first, and then cell-edge clusters is chosen based on clusters' location or interference level, therefore the original cluster structure can be preserved.

3. Conclusion

In this paper, we compared two cell-edge classification methods for 2-step graph coloring algorithm in multi-cell distributed MIMO. The simulation results revealed that the cluster-wise cell-edge classification method can maintain the original cluster structure and successfully mitigate the inter-cell interference.

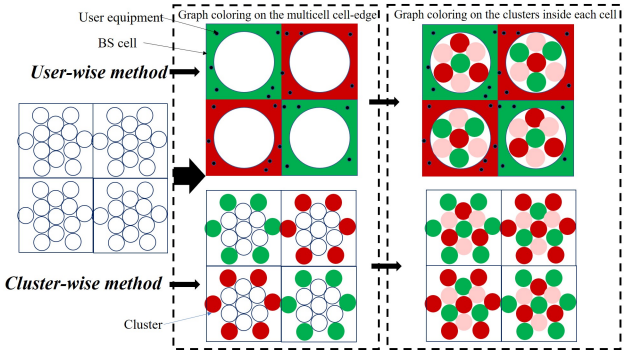

Fig. 1. 2-step graph coloring algorithm jointly used with cell-edge classification.

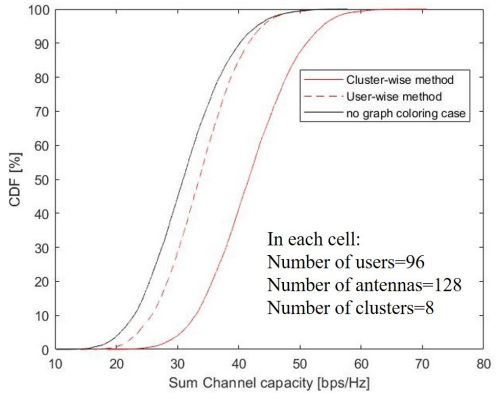

Fig. 2. The CDF of sum capacity comparing two classification methods.

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