Auction Mechanism-Based Sectored Fractional Frequency Reuse for Irregular Geometry Multicellular Networks

ABSTRACT

Modern cellular systems have adopted dense frequency reuse to address the growing amount of mobile data traffic. The system capacity is improved accordingly; however, this is at the cost of augmented Inter-Cell Interference (ICI). Recently, Fractional Frequency Reuse (FFR) has emerged as an efficient ICI management scheme in Orthogonal Frequency-Division Multiple Access (OFDMA)-based cellular systems. However, the FFR scheme that leads to optimized spectrum allocation for individual users in the irregular geometry networks is not considered in the literature. Meanwhile, in the practical wireless scenario, the users are non-cooperative and want to maximize their demands. A game-theoretic Auction Mechanism-based Sectored-FFR (AMS-FFR) scheme is proposed in this paper to optimally distribute the bandwidth resources to the individual users in the realistic multicellular network deployment. In the proposed auction mechanism, the Base Station (BS) acts as an auctioneer and is the owner of sub-carriers. The users are permitted to bid for a bundle of sub-carriers corresponding to their traffic requirements. The Monte Carlo simulation results show that the presented AMS-FFR scheme outperforms the prevailing FFR schemes in terms of achievable throughput by 65% and 46% compared to the basic FFFR and dynamic FFR-3 schemes, respectively. Moreover, the average sum rate along with the user satisfaction is significantly increased while considering a full traffic load.