Fair energy-efficient resource allocation for downlink NOMA heterogeneous networks

ABSTRACT

The increasing in energy consumptions of the current wireless networks, leads towards designing energy-efficient 5G networks. The application of non-orthogonal multiple access (NOMA) in the heterogeneous networks (HetNets) improves the spectrum utilization with the cost of efficient resource allocation. Hence, this article proposes optimal user-pairing and power allocation solutions towards achieving fair energy-efficient resource allocation in downlink femtocell NOMA-HetNets. In the proposed optimization process, the considered constraints are the user's transmission rate, transmit power budget at the base station (BS), and the interference. The energy consumption of both the transmitter and the receiver are considered to simulate the real system design. The Greedy Algorithm (GA) is used to achieve a low-complex optimal solution during the user-pairing process. Simultaneously, the max-min energy efficiency optimization approach is employed to maximize the minimum energy efficiency of the femtocell users to achieve the optimal power allocation solution. The mathematical formulation of the max-min energy efficiency is a non-convex fractional programming problem and is intractable. Thus, the fractional programming theory is adopted to transform the problem into a sequence of subtractive form, followed by the Sequential Convex Programming (SCP) approach to determine the optimal solution. Simulation results show that the proposed NOMA with optimal power allocation method using SCP and GA (NOMA-SCP-GA) achieves fair energy efficiency performance with lower complexity compared to the benchmark methods. Moreover, the minimum energy efficiency of the femtocell user is 38.22% higher than NOMA with Difference of Convex programming (NOMA-DC). The NOMA-SCP-GA method can assure 5G capability demands.

Keyword: Greedy algorithm; Heterogeneous network; Non-orthogonal multiple access; Power allocation; Sequential convex programming