Decentralized Energy Efficient Coordinated Beamforming for Multicell Systems

Energy efficient transmission is crucial for future wireless communication systems and has attracted much attention. In this paper we study the coordinated beamforming optimization for multicell multiple-input single-output (MISO) downlink systems using the energy efficiency criterion, which is still an open problem to our best knowledge. The optimization problem of interest is non-convex and in a fractional form. To solve it, we first reveal that finding the solution of the problem is equivalent to searching for a particular point on the Pareto boundary of the newly defined energy efficient rate tuples. Then, we propose to use a set of interference temperature constrained beamforming optimization problems to characterize the energy efficient rate Pareto boundary. Based on that, two efficient iterative algorithms are developed to reach the Pareto optimality and thus solve the primal problem. We show that the proposed algorithms can be carried out in a decentralized manner and are guaranteed to converge. Then, these algorithms are extended to consider imperfect channel state information using the worst-case design. Numerical results are finally provided to verify the effectiveness of the proposed schemes, and exhibit the great potential of the coordinated beamforming optimization in improving the energy efficiency of the cellular network. In particular, the results also illustrate that our proposed algorithms achieve most performance gain with a small number of iterations and thereby with limited backhaul overhead in a TDD system.