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Block-Diagonalization Precoding in a Multiuser Multicell MIMO System: Competition and Coordination

Abstract:

This paper studies a multiuser multicell system where block-diagonalization (BD) precoding is utilized on a per-cell basis. We examine and compare the multicell system under two operating modes: competition and coordination. In the competition mode, the paper considers a strategic non-cooperative game (SNG), where each base-station (BS) greedily determines its BD precoding strategy in a distributed manner, based on the knowledge of the inter-cell interference at its connected mobile-stations (MS). Via the game-theory framework, the existence and uniqueness of a Nash equilibrium in this SNG are subsequently studied. In the coordination mode, the BD precoders are jointly designed across the multiple BSs to maximize the network weighted sum-rate (WSR). Since this WSR maximization problem is nonconvex, we consider a distributed algorithm to obtain at least a locally optimal solution. Finally, we extend our analysis of the multicell BD precoding to the case of BD-Dirty Paper Coding (BD-DPC) precoding. We characterize BD-DPC precoding game for the multicell system in the competition mode and propose an algorithm to jointly optimize BD-DPC precoders for the multicell system in the coordination mode. Simulation results show significant network sum-rate improvements by jointly designing the BD or BD-DPC precoders across the multicell system in the coordination mode over the competition mode.