On the Performance of Reconfigurable Distributed MIMO in Mobile Networks

Abstract:

We propose a new distributed Multi-Input Multi-Output (MIMO) architecture for mobile networks, which we refer to as reconfigurable distributed MIMO (RD-MIMO), where the communicating mobile nodes temporarily recruit adjacent nodes to operate as distributed antenna arrays. To best serve the communicating nodes, the node clusters are continuously reconfigured due to the node mobility and varying channel conditions. The frequency of reconfiguration depends on the required system performance, exhibiting a tradeoff between performance and complexity. We propose a practical node selection scheme, which activates only a small subset of transmitters. We evaluate the asymptotic performance of the scheme as a function of the number of recruited nodes, demonstrating that there is an optimal number of such nodes. Compared with the system that blindly activates all available transmitting nodes, our results show that the proposed RD-MIMO architecture with node selection achieves superior performance, especially as evident at low SNR. Furthermore, assuming the Brownian motion model, an analytical expression for the reconfiguration time to select a new cluster of transmitting nodes is obtained. Numerical results show that the obtained expression serves as a good estimation for the order of magnitude of the cluster reconfiguration time for other mobility patterns, such as the random walk model.