
The DoF Region of the Three-Receiver Gaussian MIMO Broadcast Channel With Receiver Message Side Information

Abstract:

We consider the three-receiver Gaussian multiple-input multiple-output broadcast channel with an arbitrary number of antennas at the transmitter and the receivers. We investigate the degrees-of-freedom (DoF) region of the channel when each receiver requests a private message, and may know some of the messages requested by the other receivers as receiver message side information (RMSI). We establish the DoF region of the channel for all 16 possible non-isomorphic RMSI configurations by deriving tight inner and outer bounds on the region. To derive the inner bounds, we first propose a scheme for each RMSI configuration, which exploits both the null space and the side information of the receivers. We then use these schemes in conjunction with time sharing for 15 RMSI configurations, and with time sharing and two-symbol extension for the remaining one. To derive the outer bounds, we construct enhanced versions of the channel for each RMSI configuration, and upper bound their DoF region. After establishing the DoF region, in the case where all the nodes have the same number of antennas, we introduce some common properties of the DoF region, and the capacity region of the index coding problem.