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Degrees of Freedom of Wireless Interference Network

Abstract:

The degrees of freedom (DoF) concept is very useful for studying the multi-user communications system at high signal-to-noise ratio region. The research on DoF leads to an important technology advancement in wireless communications, the interference alignment. The idea of interference alignment is to design the transmit signals structurally such that the interference signals from multiple interferers are aligned together to reduce the occupied dimensions at receivers. In this thesis, we would like to study several important problems in this area: the DoF region of MIMO interference channel with reconfigurable antennas and the DoF region of interference networks with general message demands.

For the first problem, we derive an outer bound of the DoF region and show that it is achievable via time-sharing or beamforming except for one special case. As to this special case, we develop a systematic way of constructing nulling and beamforming matrices to achieve the region. In addition, our scheme has an interesting space-frequency interpretation. For the second problem, we study a generalized interference network which includes multiple unicasts, multiple multicasts and the combination of them as special cases. We propose to do interference alignment using multiple base vectors and aligning the interference at each receiver to its largest interferer. Such a scheme can be used to achieve any point in the DoF region.