

A two-way active parallel channel refers to a communication link between two transceivers, where the subchannel gains between the two transceivers can be adjusted such that a given performance criterion is optimized. A two-way active channel can have reciprocal subchannels, meaning that the subchannel gains in both communication directions are identical. Otherwise, if the gains of each subchannel in the two communication directions are different, the active channel is referred to as non-reciprocal. In this paper, we consider the problem of sum-rate maximization for reciprocal and non-reciprocal two-way active channels under two constraints on the transceivers' transmit powers and a third constraint on the channel power (i.e., the sum of squared of the subchannel gains). We prove rigorously that for such active channels, in order to maximize the sum-rate, only a subset of the subchannels will have to be active. We also provide the optimal values of the subchannel gains and the optimal values of the transceivers' transmit powers over different subchannels in closed forms. Simulation results show that parallel active channels can outperform their passive counterparts, where the subchannel gains are fixed, and thus, they cannot be adjusted.