

Exploiting Full-Duplex Receivers for Achieving Secret Communications in Multiuser MISO Networks

Abstract:

We consider a broadcast channel in which a multi-antenna transmitter (Alice) sends K confidential information signals to K legitimate users (Bobs) in the presence of L eavesdroppers (Eves). Alice uses multiple-input multiple-output (MIMO) precoding to generate the information signals along with her own (Tx-based) friendly jamming (FJ). Interference at each Bob is removed by MIMO zero-forcing. This, however, leaves a “vulnerability region” around each Bob, which can be exploited by a nearby Eve. We address this problem by augmenting Tx-based FJ (TxFJ) with Rx-based FJ (RxFJ), generated by each Bob. Specifically, each Bob uses self-interference suppression to transmit a friendly jamming signal, while simultaneously receiving an information signal over the same channel. We minimize the powers allocated to the information, TxFJ, and RxFJ signals under given guarantees on the individual secrecy rate for each Bob. The problem is solved for the cases when the eavesdropper's channel state information is known/unknown. Simulations show the effectiveness of the proposed solution. Furthermore, we discuss how to schedule transmissions when the rate requirements need to be satisfied on average rather than instantaneously. Under special cases, a scheduling algorithm that serves only the strongest receivers is shown to outperform the one that schedules all receivers.