

On the Optimal Power Allocation for Two-Way Full-Duplex AF Relay Networks

Abstract:

This paper investigates the optimal power allocation that maximizes the system utility for a full-duplex (FD) amplify-and-forward (AF) two-way relay network (TWRN) with a rate outage and a power constraint. Both cases of an individual and a sum power constraint are considered. To formulate the corresponding optimization problem, closed-form expressions of outage probabilities are needed. With FD transceivers, the derivation of such closed-form expressions become too involved. Thus, approximate closed-form expressions were derived instead. The resulting optimization problem is still non-convex and difficult to solve. Via solving a series of approximate convex problems, a successive convex approximation (SCA) algorithm was proposed. Our simulation results demonstrate the accuracy of the approximate closed-form expressions of outage probabilities and that the proposed SCA algorithm achieves near-optimal performance and significantly outperforms the full power allocation under the individual power constraint and uniform power allocation under the sum power constraint both in system utility and in power consumption. Our results further show that simultaneous power transmission for all relay nodes with judicious power allocation generated by the SCA algorithm achieves of performance gain under the individual power constraint, and of performance gain under the sum power constraint over the relay selection scheme.