

Robust beamforming and artificial noise design in interference networks with wireless information and power transfer

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Abstract In this paper, the robust beamforming and artificial noise design is investigated in two-user interference networks with wireless information and power transfer. Specifically, we focus on the secure communication of the two pairs in the presence of an energy receiver (ER) which acts as the potential eavesdropper and intends to wiretap the confidential message transmitted to one of the information receivers (IRs). With only imperfect eavesdropper's channel state information (ECSI) at the transmitters, our goal is to minimize the total transmit power, while guaranteeing the worst-case secrecy rate requirement at the wiretapped IR, the signal-to-interference-plus-noise ratio requirement at the wiretap-free IR and the energy harvesting requirement at the ER. In particular, we first model the imperfect ECSI in the sense of ellipsoidal uncertainties. Then, our design goal can be further reformulated as a two-stage optimization problem. With the help of rank relaxation and one-dimensional line search, the considered two-stage problem can be solved efficiently. Simulation results verify the effectiveness of the proposed design in different scenarios.

Keywords Robust beamforming · Artificial noise · Semidefinite program (SDP) · Interference networks · Simultaneous wireless information and power transfer (SWIPT)

1 Introduction

Relying on wireless networks for transmission of important information, such as banking related data communications or credit card transactions, the security of wireless network has become a critical issue in wireless applications [1, 2]. Recently, there are growing interests on physical layer security, which can guarantee the perfect secrecy communication from the information-theoretic perspective [3]. The basic idea of physical layer security is to exploit the randomness of wireless channel and signal processing techniques to secure the confidential message transmitted to the intended receiver, while preventing the eavesdropper from wiretapping the information. In particular, the multiple-input multiple-output multiple-eavesdropper wiretap channel in a three nodes scenario is studied in [4, 5], which reveals that having multi-antenna at the transmitter can improve the secrecy performance of the system effectively. Some works focus on dealing with the security issues in wireless sensor networks (WSNs) [6], multiuser networks [7, 8], large-scale multiple-input multiple-output (MIMO) systems [9, 10] and relay networks [11, 12].

Wireless power transfer constitutes an important technique for achieving high energy efficiency promised by green radio. Recently, a significant amount of research effort has been dedicated to wireless power transfer due to the tremendous success of WSNs, which have been widely applied for intelligent transportation, environmental monitoring and

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