The Department of Electrical and Computer Engineering

Announces the

Final Defense of Dissertation

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Date: August 22, 2019
Time: 10:00 am – 12:00 pm
Location: Winston Chung Hall, Room 202

Physical Layer Security with Full-Duplex Radio in Wireless Networks

Abstract:

Different to traditional security methods in wireless networks which are mostly implemented in the higher layer of the networks, i.e. MAC layer and network layer, physical layer security (PLS) is a technique that provides secrecy based on information-theoretic model which does not account for any computation capability assumption or pre-installed standardized secret key generation. In this work, we study the techniques for improving PLS of wireless networks with full-duplex radio. Two topics will be presented: (1) we analyze a two-phase scheme for secret information transmission. In the first phase, an anti-eavesdropping channel estimation (ANECE) method is applied which allows full-duplex users to find their channel state information (CSI) but suppresses Eve's ability to obtain its CSI. In the second phase, secret information is transmitted between the users. We assumes every node knows the prior statistical knowledge of its CSI and we use mutual information to analyze the secret rate of the network, from which lower and upper bounds on the secure degrees of freedom are derived; (2) we present optimal designs of the pilots for ANECE based on two criteria. The first is to optimize the minimum mean squared error (MMSE) channel estimation for the users, and the second is to maximize the mutual information between the pilot-driven signals observed by the users. Closed-form optimal pilots are shown under both criteria but subject to a symmetric and isotropic condition. Algorithms for computing the optimal pilots are shown for general cases.