Vincent POOR

Abstract :

Non-orthogonal multiple access (NOMA) is considered to be a promising multiple access (MA) technique for 5G networks, due to its advantages over conventional orthogonal multiple access (OMA) schemes, in terms of spectral efficiency, cell-edge throughput, and energy efficiency. Power-domain NOMA (in the following simply referred to as NOMA) allows multiple users to transmit with different transmission power levels, but using the same radio resources, such as subcarrier channels, codes and time slots. Specifically, superposition coding is applied at the transmitter to enable user-multiplexing, while the receiver adopts multiuser separation techniques, such as successive interference cancellation (SIC), to remove the co-channel interference and decode the signal. According to the NOMA principle, the users with higher channel gains can obtain the prior information of the weaker users. On the other hand, the users with stronger channel conditions can serve as relays to decode and forward the weaker users' messages, so that the system performance can be improved.

First, we will explore security issues in NOMA networks in the presence of eavesdroppers and / or untrusted relays. NOMA opens up some natural security questions since the so-called strong users will decode the weak users' transmitted messages, while the weak users will be naturally degraded in terms of signal to noise ratio. In particular, it will be interesting to investigate how to design techniques to "re-balance" the users from a security standpoint. In this direction, we will exploit our earlier results on the generation of symmetric keys from shared randomness and embed such approaches in the NOMA channel state estimation (CSI) estimation; such keys can be used by weak users to provide a minimum level of security. Secondly, we will investigate SIC approaches, focusing on a NOMA network with one base station (BS) and multiple single-antenna mobile users. It is known that there exists a trade-off between the NOMA cluster size and the incurred SIC error. Larger clusters lead to larger errors, but they are desirable from the spectrum efficiency and connectivity point of view. We intend to investigate the possibility of using machine learning based interference cancellation techniques for the NOMA uplink/downlink.