# Full-Duplex Bidirectional Secure Communications under Perfect and Distributionally Ambiguous Eavesdropper's CSI


## Abstract:

Consider a full-duplex (FD) bidirectional secure communication system, where two communication nodes, named Alice and Bob, simultaneously transmit and receive confidential information from each other, and an eavesdropper, named Eve, overhears the transmissions. Our goal is to maximize the sum secrecy rate (SSR) of the bidirectional transmissions by optimizing the transmit covariance matrices at Alice and Bob. To tackle this SSR maximization (SSRM) problem, we develop an alternating difference-of-concave (ADC) programming approach to alternately optimize the transmit covariance matrices at Alice and Bob. We show that the ADC iteration has a semi-closed-form beamforming solution, and is guaranteed to converge to a stationary solution of the SSRM problem. Besides the SSRM design, this paper also deals with a robust SSRM transmit design under a moment-based random channel state information (CSI) model, where only some roughly estimated first and second-order statistics of Eve's CSI are available, but the exact distribution or other high-order statistics is not known. This moment-based error model is new and different from the widely used bounded-sphere error model and the Gaussian random error model. Under the consider CSI error model, the robust SSRM is formulated as an outage probability-constrained SSRM problem. By leveraging the Lagrangian duality theory and DC programming, a tractable safe solution to the robust SSRM problem is derived. The effectiveness and the robustness of the proposed designs are demonstrated through simulations.