Institute for Digital Communications

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Master Thesis

Multi-Objective Optimization for Power Efficient Active IRS-Assisted Communication Systems

Intelligent reflecting surfaces (IRSs) are emerging as promising enablers for the next generation of wireless communication systems, because of their ability to customize favorable radio propagation environments. However, with the conventional passive architecture, IRSs can only adjust the phase of the incident signals limiting the achievable beamforming gain. To fully unleash the potential of IRSs, a more general IRS architecture, i.e., active IRSs, has been proposed in recent works. In particular, equipped with reflection-type amplifiers, active IRSs can not only reflect the incident signals by manipulating the phase programmable IRS elements, but also amplify the reflected signal with the support of an extra power supply.

In practice, the total available power of communication systems is limited. On the other hand, to realize the potential gains facilitated by active IRSs, an appropriate amount of power has to be assigned to each element of the active IRS from the limited available power. As a result, compared to systems assisted by conventional passive IRSs, it is more important to smartly balance the base station (BS) transmit power and the IRS amplification power such that the quality-of-service (QoS) requirements of the users can be satisfied while guaranteeing power efficient communication. In this thesis, we consider an active IRS-assisted wireless communication system and investigate the power efficient resource allocation algorithm design for the considered communication system. The power efficient resource allocation design is formulated as a multi-objective optimization problem which jointly minimizes the BS transmit power and the amplification power at the active IRS. A corresponding optimization algorithm will be developed in the thesis.

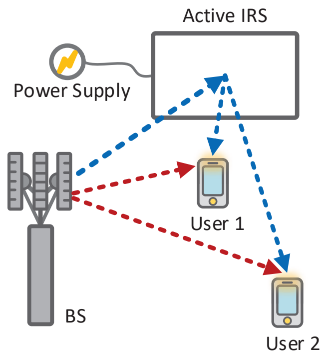

Figure 1: An active IRS-assisted multiuser communication system.

Main guidelines for the work:

- Acquisition of basic knowledge in communications and convex optimization theory
- Formulation of the optimization problem and development of a corresponding algorithm
- Verification of the adopted approach and presentation of results via simulation

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