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Keio University

Thesis Abstract

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Thesis Title

Capacity Enhancements to Wireless MIMO Systems: Channel Feedback, Keyhole Mitigation and Multi-User Support

Thesis Summary

Recently, MIMO technology, the use of multiple antennas at the transmitter and the receiver, has emerged as a potential solution to meet the huge demand in wireless bandwidth. However, some theoretical requirements and assumptions have challenged its implementation in practice.

In this work, we provide our contributions towards this end by addressing some of these challenges in both single-user (SU-MIMO) and multi-user (MU-MIMO) settings.

We start by addressing MIMO challenges pertaining to single-user systems. We consider in chapter 2 the need for a fast channel feedback phase, as MIMO capacity gains are conditional upon the availability of channel estimates at the transmitter. By means of orthogonal projections, we provide such fast feedback at half the signaling of the conventional approach.

Subsequently, we consider in chapter 3 the keyhole problem where the propagation environment has a single degree of freedom regardless of the number of transmit antennas. Related literature seems to consider such degeneration hopeless. Contrarily, we show that the use of relay-assisted communications as well as a carefully defined power allocation makes the keyhole effect mitigation feasible.

Ultimately, chapter 4 treats the problem of user scheduling in MU-MIMO. We provide an efficient feedback scheme where the number of required feedbacks and the computational burden of exhaustively searching for best users at the transmitter's side are substantially reduced. Afterwards, we provide a Quality of Service (QoS) aware scheduling scheme that allows meeting the demand of delay-constrained users.