CCIT Report #492 June 2004

Linear precoding via conic optimization for fixed MIMO receivers

Ami Wiesel, Yonina C. Eldar, and Shlomo Shamai (Shitz)

Department of Electrical Engineering

Technion - Israel Institute of Technology *

June 28, 2004

Abstract

We consider the problem of designing linear precoders for fixed multiple input multiple output (MIMO) receivers. Two different design criteria are considered. In the first, we minimize the transmitted power subject to signal to interference plus noise ratio (SINR) constraints. In the second, we maximize the worst case SINR subject to a power constraint. We show that both problems can be solved using standard conic optimization packages. In addition, we develop conditions for the optimal precoder for both of these problems, and propose two simple fixed point iterations to find the solutions which satisfy these conditions. The relation to the well known downlink uplink duality in the context of joint downlink beamforming and power control is also explored. Our precoder design is general, and as a special case it solves the beamforming problem. In contrast to most of the existing precoders, it is not limited to full rank systems. Simulation results in a multiuser system show that the resulting precoders can significantly outperform existing linear precoders.

1 INTRODUCTION

Multiple input multiple output (MIMO) systems arise in many modern communication channels, such as multiple user communication [3], and/or multiple antennas channels [4]. It is well known that the use of multiple antennas promises substantial capacity gains when compared to traditional single antenna systems. In order to exploit these gains, the system must deal with the distortion caused by the channel and/or the interference. The conventional way to deal with these distortions is receiver optimization. Recently, the quest for better performance with lower complexity led researchers to also optimize the transmitter [5–10],

*e-mails: amiw@tx.technion.ac.il, yonina@ee.technion.ac.il and sshlomo@ee.technion.ac.il.
Presented in part in [1, 2]. The work was supported in part by the NewCom project.