

Beamforming in MIMO Wireless Communications

ECE Scholarly Paper Presentation

By Fred A. Casca

Scholarly Paper Advisor: Dr. Bernd-Peter Paris

Academic Advisory: Dr. Jill K. Nelson

Student Union II - Room 5

Wednesday, April 29, 2009 3-4 PM

ABSTRACT

To improve MIMO wireless communications where the number of transmit antennas exceeds the number of receiver antennas transceivers may incorporate beamforming. In order for a transmitter to properly implement beamforming (i.e., determine the beamforming matrix), it needs to know properties of the channel over which the wireless communication is conveyed. Accordingly, the receiver determines the channel response (\mathbf{H}) and then provides it as a feedback to the transmitter to determine the properties of the channel. An issue with this approach is the size of the feedback packet, which may be so large that, during the time it takes to send it to the transmitter, the response of the channel has changed. To reduce the size of the feedback, the receiver may decompose the channel using singular value decomposition (SVD) and send information relating only to a calculated value of the transmitter's beamforming matrix (\mathbf{V}) as the feedback information. However, the SVD approach can reduce the combined channels' coherence bandwidth as seen by the receiver, which is problematic for some applications. Researchers at Broadcom Corporation developed a model that determines beamforming coefficients based on the channel information and a smoothness criterion. This paper discusses how beamforming is accomplished and how the proposed model is implemented so that beamforming coefficients with negligible adverse affects as produced by the limitations of SVD beamforming approach are achieved.