EFFECT OF MATCHING NETWORKS FOR VECTOR ANTENNAS ON MIMO CHANNEL CAPACITY

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The channel capacity that can be achieved in a MIMO system is dependent on the properties of the multi-element antennas employed. The elements of these antennas must all be well matched at a common frequency and the coupling between elements must be minimal. Good antenna design allows for these goals to be realized to a substantial extant. However, very compact MIMO antennas required for portable devices are not ideal, perfectly matched, uncoupled antennas. Thus, it is necessary to investigate methods that optimize the performance of realistic antennas in a MIMO configuration. Vector Antennas are a class of compact MIMO antennas that consist of co-located elements (eg. loops and dipoles) that can sense more than one component of the incident Electromagnetic field at a point (Konanur et al, *IEEE Trans. Microwave Theory and Techniques*, **53**, 1837-1844, June 2005). In this paper the use of lossless filters to enhance the MIMO channel capacity that can be achieved by Vector Antennas is explored.

The use of a lossless matching network between the load and the receiving antenna has been proposed (J.W. Wallace, A.Jensen, *IEEE Trans. Wireless Commun*, **3**, 1317-1325, July 2004) as a means of efficiently transferring power from the antenna to the load network. We design and use such filters in conjunction with various practical vector MIMO antennas. These antennas are placed in a realistic indoor scattering environment and the channel matrices are measured for different channel realizations. Subsequently, the Expected Mutual Information (EMI), with and without the filters, is calculated and the increase in EMI is evaluated. The expected mutual information serves as a lower bound on the achievable ergodic capacity. The increase in capacity is primarily a result of better power transfer to the loads, achieved as a result of a conjugate match between the antenna and input impedance of the filter on the one hand and the output impedance of the filter and impedance of the load on the other hand.

Preliminary results indicate that for a four-element MIMO antenna consisting of a loop and three dipoles, a 4-dB gain in SNR can be achieved by using the filter network. The feasibility of implementing a practical filter network with passive elements will also be explored.

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