INCREASING CHANNEL CAPACITY FOR LINEAR ARRAYS USING POLARIZED ANTENNAS

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MIMO antennas have been used in wireless communications to increase channel capacity. Conventional MIMO systems employ antenna elements with $\approx \lambda/2$ spacing in rich scattering environment to achieve decorrelation of fading path gains. For applications with area constraints like mobile communications this limits the number of antennas that can be used. In these scenarios compact yet reliable antennas are needed. Recently it was proposed that the use of polarized antennas can lead to a potentially three fold increase in capacity (M. R. Andrews, *Nature*, **409**, 316-318, Jan, 2001).

Linear array antennas are very versatile and find a variety of applications. In this paper we study the benefits of polarized antennas for linear arrays. A mathematical framework to analyze the radiated fields is developed. We show that for linear arrays there is a three fold increase in the degrees of freedom with the use of polarized antennas. This implies the existence of three orthogonal channels under suitable scattering conditions. To quantify the performance improvement, a co-located tripole antenna has been designed. This is important because if the antennas are not co-located then space diversity can also improve the performance. The individual elements of the tripole are printed dipoles. The antennas have been first optimized using simulations and then fabricated. The return loss for each element is below $-10\ dB$ and mutual coupling between individual elements below $-20\ dB$.

To evaluate the performance benefits in a realistic scenario, channel measurements were performed in an indoor NLOS environment using linear arrays of tripoles. The scatterers were placed in the azimuthal plane at randomly generated angles with uniform probability density function. This is a popular model for azimuthal distribution of scatterers. The average capacity for the system using tripole antennas shows a ≈ 3 fold increase in capacity for a wide range of received SNRs as compared to the system using same number of dipole antennas. Simulations were performed using more detailed channel models and the results are in good agreement. This demonstrates that compact polarized antennas can be used to achieve significant improvement in capacity performance for linear arrays.

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2. B - Fields and Waves

3. (a)

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5. No special instructions