Investigating Pattern Combinations for Various CAP-MIMO Applications

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Abstract

Continuous Aperture MIMO (CAP-MIMO), is a field of study that promises improvements in transmission and reception for communication networks. Using a 2D transmission and receiving array, the generation of patterns for different MIMO applications can be determined.

Ⅰ. Introduction

Within a network where boundaries must be continually expanded, combining multiple concepts for system improvement is essential. The hybridization of orthogonal multiplexing and analog beamforming which created CAP-MIMO allows for greater exploitation of channel capacity and makes it easier to achieve near-optimal performance with minimum complexity. [1]

Assuming a semi-continuous array of discrete antennas, which can be optimized for different applications, specifically for LoS. Combining phased antennas and MIMO, applications to short and long-range LoS can be discussed.

Additionally, CAP-MIMO allows for different optimal solutions depending on certain characteristics, such as the number of transmitting and receiving antennas, the distance between antennas, the allowable maximum transmission power, and the desired frequency. [2]

Previous works leave a gap in a complete analysis of sub-THz frequencies, as well as studies in LoS urban environments. This study demonstrates an optimization of the number of antennas based on a fixed frequency.

Ⅱ. Antenna Array Optimization

For the scope of this problem, two-dimensional transmission and receiving antennas (TX and RX respectively) are used. Additionally, the antennas are assumed to be vertically polarized dipole antennas. Through an understanding of dipole antenna propagation, a complex sinusoidal waveform is assumed. This allows for the derivation of the first and second-order derivative matrices. If a negative constant is affixed to the sinusoid, the resulting Hessian matrix will be a positive definite matrix. This allows for an optimal solution to exist.

With a semi-continuous array of antennas, an optimized solution can minimize the propagation between feed antennas and apertures. Based on different distances, the required frequency and number of antennas needed changes. [3]

From this analysis, the frequency can be fixed, and the resulting parameters will be analyzed.

Ⅲ. Conclusion

Urban environments and a vastly-growing network requires an improved method of information transmission.

Through this work, an optimization of CAP-MIMO will be presented. This allows for the conduction of simulations at different frequencies, as well as the number of TX and RX.

Extension of this simulation will be applied to the sub-THz band, to assist in LoS-MIMO modeling. Additionally, the optimization of the phase profile of each antenna will be conducted with each sub-THz simulation. The combination of these two simulations will allow for greater understanding of how CAP-MIMO can build upon existing structures.

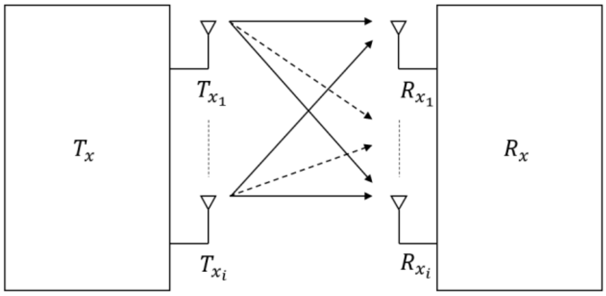

Figure 1: Transmission and Receiving Antenna System Optimization

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References

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