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Radio Waves Carrying Orbital Angular Momentum

Microwaves and Antenna Engineering Group

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Motivation

Wireless communication based on the electromagnetic field properties of orbital angular momentum (OAM) has gained a lot of interest for multi-input-multi-output (MIMO) communication schemes. From a field theoretical perspective, OAM is well understood and can be easily quantified in electromagnetic radiation. However, when it comes to the optimization of OAM-based communication, there are still many unknowns, e.g., relative position, orientation, size, and termination of transmitting and receiving arrays.

The research is to investigate the properties of OAM waves with respect to wireless communication and to electromagnetic interference. There are many open questions on OAM carrying waves, both from a more fundamental electromagnetic perspective (reflection, diffraction, scattering, shielding, superposition/interference etc.) as well as from a more applied communication engineering perspective (individual antenna choice, array design, useful range of distances, bandwidth considerations, etc.).

Research Fronts

The research teams have proposed a mixed-mode matrix representation of scattering parameters that is suitable for the investigation of wireless communication based on OAM. Fig. 1 illustrates the wireless communication between OAM-based antenna arrays above an infinite ground plane.

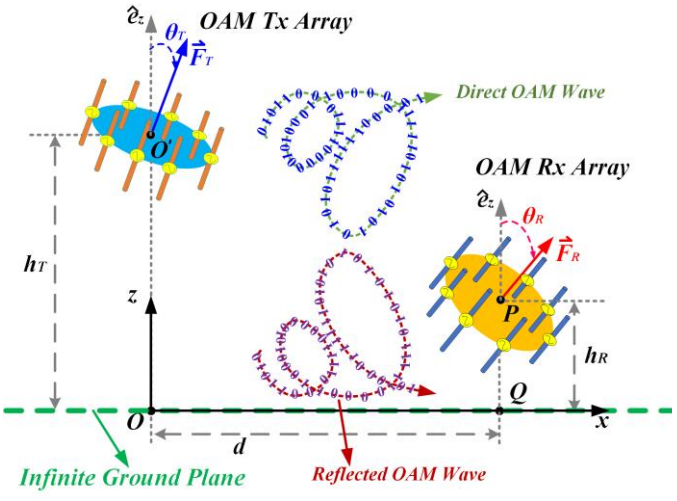

Fig. 1 Illustration of wireless communication between OAM-based antenna arrays above an infinite ground plane.

Selected Publications

- W. Park, L. Wang, H. Brüns, D. G. Kam and C. Schuster, "Introducing a Mixed-Mode Matrix for Investigation of Wireless Communication Related to Orbital Angular Momentum," in IEEE Transactions on Antennas and Propagation, vol. 67, no. 3, pp. 1719-1728, March 2019.
- L. Wang, W. Park, C. Yang, H. -D. Brüns, D. G. Kam and C. Schuster, "Wireless Communication of Radio Waves Carrying Orbital Angular Momentum (OAM) Above an Infinite Ground Plane," in IEEE Transactions on Electromagnetic Compatibility, vol. 62, no. 5, pp. 2257-2264, Oct. 2020.
- L. Wang, M. Wulff, C. Yang, W. Park and C. Schuster, "Numerical Investigation of OAM Based Indoor Communication in a Corridor with Electrical Conducting Walls," 2020 International Conference on UK-China Emerging Technologies (UCET), 2020, pp. 1-4.

Researchers

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Network Demonstration