INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Metasurface-based Converters for Controlling Guided Modes and Antenna Apertures

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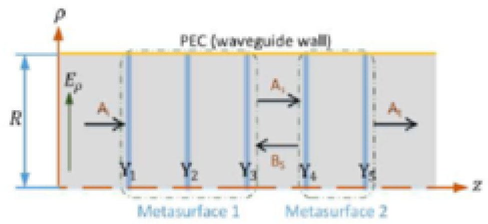

OVERVIEW

An inhomogeneous mode converter that consists of stacked multiple patterns

- Allows for conversion of phase, amplitude, and polarization distribution of the input
- Improved efficiency, flexibility, and bandwidth compared to existing antennas

BACKGROUND

Antenna technology is a key component of several industries, from communications to aerospace, and even healthcare. Metasurface-based devices that control polarization have previously been used to present a set of antenna systems. One of the main applications of metasurfaces in antenna technology is the design of polarization selective surfaces (PSS) that can control the polarization of electromagnetic waves. PSS can be used to enhance the performance of antennas by providing high polarization selectivity, which can help to mitigate interference and improve signal quality. Additionally, metasurfaces have been used to design beam steering antennas, which can control the direction of the radiated beam by manipulating the polarization of the electromagnetic wave. Still, these devices are formed from cascaded homogenous patterned surfaces, which only allow a set impedance for the entire system. So, a need exists for a method to improve the pliability of this technology.

INNOVATION

Researchers have created an inhomogeneous mode converter that consists of stacked multiple patterns which allow for conversion of phase, amplitude, and polarization distribution of the input with great flexibility. This approach permits the modes to losslessly be converted from single mode to another single mode, though it may also convert from single to multi, or multi to multi modes. The technology is modeled to have superior efficiency, more flexibility, and

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Category

Hardware
Engineering & Physical Sciences
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greater bandwidth than existing antennas. It is based upon the modal network theory and the Discrete Hansel Transform as the working basis. Several field profile types are possible, from generalized to azimuthally invariant or variant types. Unlike existing antennas, these mode converters can successfully transform the phase, amplitude and polarization distribution of a field profile, as well as its polarization.

References

1. Alsolamy F, and Grbic A. , Radial Gaussian Beam Metasurface Antenna. 2020 IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting, 2020, pp. 743-74410.1109/IEEECONF35879.2020.9329945