Surface Wave Cloaking using Transformation Optics

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Recently, there has been an increasing interest in the study of manipulating surface waves from microwave to optical frequencies [1, 2], especially for the design of conformal antennas and devices in communications and radar applications [3]. Some of those designs based on metamaterials/metasufaces suffer from various problems, for example, they are highly dispersive, intrinsically narrow-band, lossy and highly anisotropy [4].

The objective of this paper is to present a new design for surface wave manipulation via the demonstration of surface wave cloaking. The proposed structure consists of a metallic object, hidden underneath a dielectric bump (rotationally symmetric graded index media above a ground plane). We will discuss two main aspects of this work, including an analytical study of surface wave cloak and simulation results. The cloak has been manufactured and measured at 8-10GHz.

One of significant findings from this study is that the proposed design process is robust and can be applied to a broad range of designs concerning surface wave propagation. The technique can be extended for designs with arbitrary shapes and electrically large objects with coatings of artificial materials of only a fraction of a wavelength in thickness. Fig. 1 illustrates some results of proposed surface wave cloaks from numerical simulation and measurements.

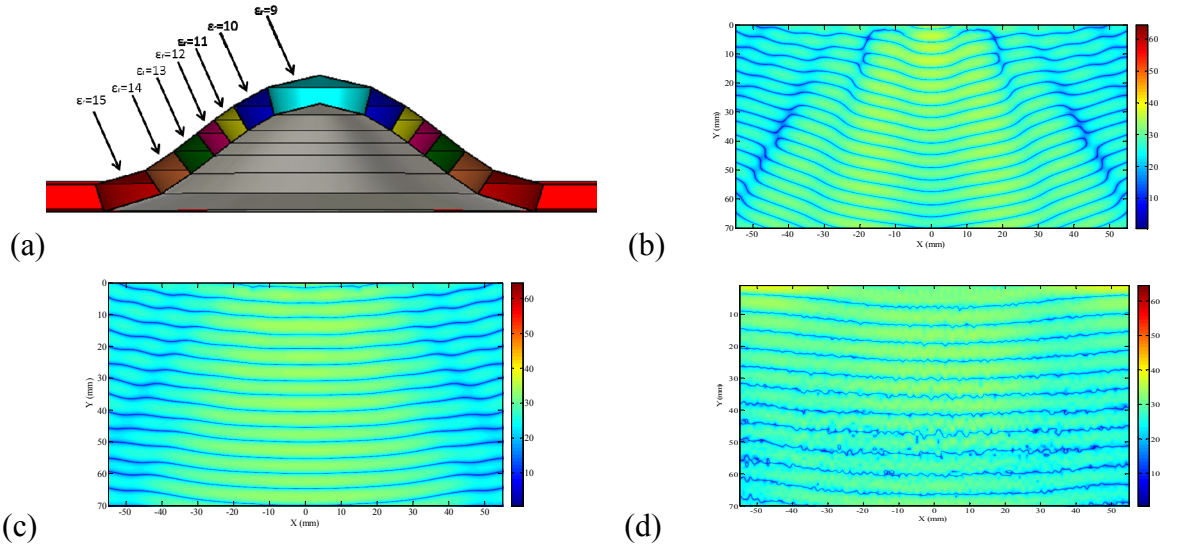

Figure 1: Side view of the structure (a); Field distribution of surface wave from (b) Uncloaked Sample; Cloaked Sample: simulation (c) and experimental results (d) for 10 GHz.

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[2] P. A. Huidobro, M. L. Nesterov, L. Martín-Moreno and F. J. García-Vidal, *Nano Lett.*, **10**, 2010, pp 1985–1990.
[3] C. Pfeiffer and A. Grbic, *IEEE Trans. Antennas Propag.*, **58**, 2010, pp. 3055-3059
[4] C. Argyropoulos, E. Kallos, and Y. Hao, *Appl. Phys. A*, **103**, 2011, pp. 715-719.