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S4 - AN APPROPRIATE SIMULATION SOFTWARE FOR EXAMINING TRANSMISSION IN META-SURFACES?

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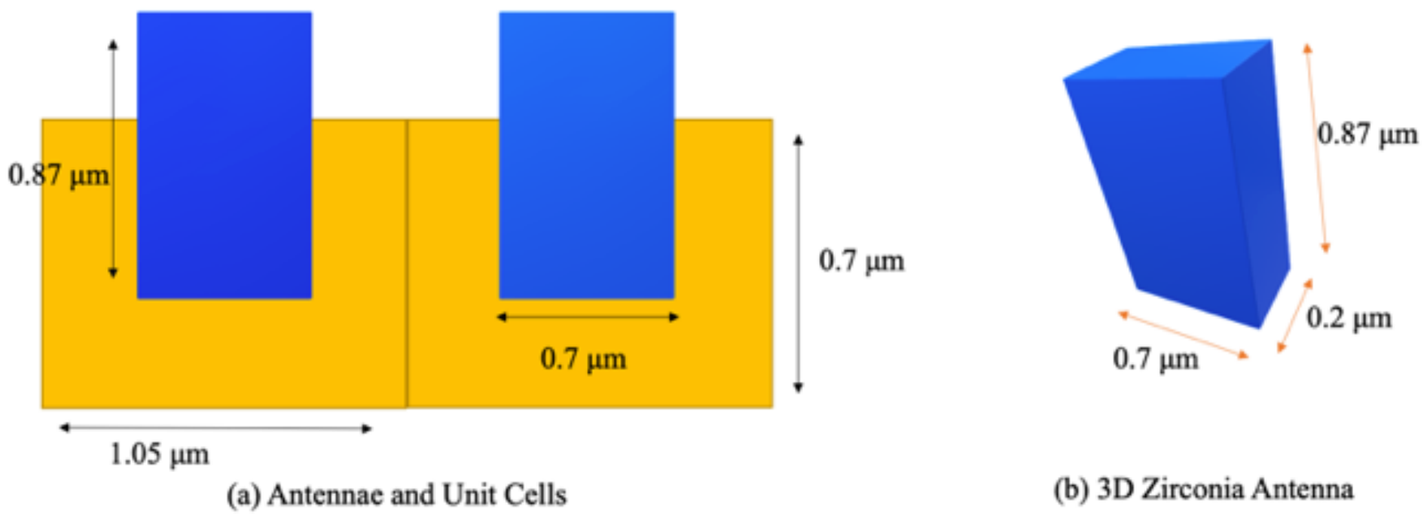
INTRODUCTION

At present, Finite-Difference Time-Domain (FDTD) is a preferred method for simulating electromagnetic transmission through meta-surfaces. However, it is slow. Stanford Stratified Structure Solver (S4) is a software similarly designed to simulate electromagnetic propagation. As S4 is capable of producing results faster than FDTD, it is of interest to explore whether S4 can be used in conjunction with FDTD to reduce simulation times. To judge this, two surfaces will be simulated with S4 and the results will be compared against those produced by FDTD.

Image 1: Antenna design



SURFACE 1

In the first S4 simulation, the meta-surface was composed of a relatively thick glass slab with an array of Zirconia (ZrO2) antennae placed upon it. Two types of simulation were run with this software. Firstly, a single transmission result was produced over a range of wavelengths. Then multiple simulations were run, with the antennae dimensions changing between each.

SURFACE 2

As Iridium Tin Oxide (ITO) causes more complex dispersion patterns, the second set of simulations involved modifying the previous meta-surface by inserting a layer of this. Both the single transmission and set of multiple simulations were repeated with this surface.

RESULTS & DISCUSSION

S4 produced useful results for both surfaces. The general trends were appropriately present in all the simulations. Despite this, there were some clear discrepancies between the results produced by S4 and FDTD. However, analysis of these results indicated that the differences were due to the nature of S4, and therefore were systemic and easily adjusted.

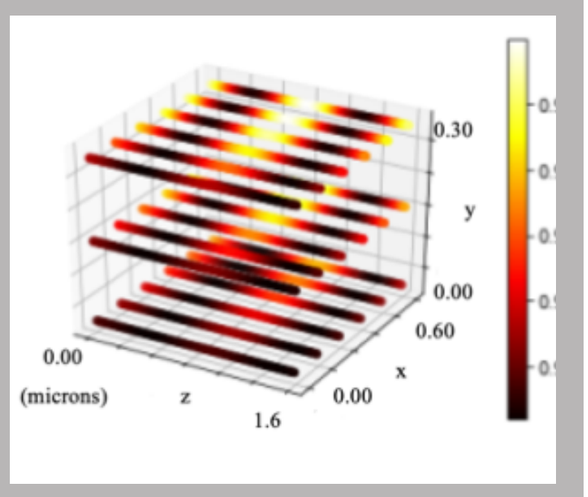


Image 2: Results from 3D antenna adjustments

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