Reconfigurable Band Rejection and Band-Pass Frequency Selective Structures

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Traditional frequency selective surfaces employ planar arrangements, and typically exhibit poor filtering responses similar to single-stage filters. Because of this, recent literature has explored "thicker" frequency selective structures (FSSs) to design rejection filters with sharp roll-offs. A class of thick FSSs was recently considered to add inductance and capacitance to the unit cell and provide design flexibility and frequency control for the FSS. In effect, these designs realize a higher-order multi-stage filter to achieve sharper roll-offs (versus single-stage filtering in planar designs). However, these thick FSSs still lack tuning capability for practical application. (B. Munk, *Frequency Selective Surfaces: Theory and Design*, 2000; B. Li and Z. Shen, *IEEE Trans. Microwave Theory Techniques*, 61, 3578-3589, 2013).

In this work, we expand upon the thick FSS concept to design a new class of reconfigurable FSSs that operate across a wide band of frequencies. To do so, we introduce a novel printed FSS unit cell that provides frequency response control in the same manner as a multi-band filter. This is done by dynamically adjusting the geometry of the FSS elements using switches. This dynamic frequency reconfiguration is achieved using a modified dipole element that can take several forms depending on whether suitably placed switches are open or closed. Tuning is achieved by controlling which of the switches is open or closed. The structure also displays desirable properties, including increased selectivity (relative to previous work) for narrowband designs.

This presentation will explore various element geometries to implement reconfigurable FSSs with emphasis on frequency and bandwidth control. Our most recent design considerations achieve performance stability with respect to both incidence angle and polarization. A goal is to present a final design that can be fabricated at low cost. Thick FSS structures will be explored for both band rejection and band-pass applications, and an ultimate goal is to employ these multi-band filters as reconfigurable cover layers over broadband antennas. Measurements and comparisons to analyses will be presented at the meeting.