A Single-Layer Frequency Selective Surface With Dual-Wide-Band Response

Nibirh Jawad* and Loïc Markley
The University of British Columbia, Kelowna, BC V1V 1V7

Frequency selective surfaces (FSS) have seen many applications as free-space filters across the electromagnetic spectrum. Their frequency selectivity has been used to design radomes, multiband antennas, and electromagnetic absorbers. The four general types of filters can be designed using arrays of four basic conductive shapes: high-pass using patches, low-pass using meshes, band-pass using slots, and band-stop using loops or strips. These surfaces, however, are all single band filters. In order to make multiband filters, multiple FSS layers are typically used. In this work, we explore a design based on conductive strips that produces a dual-band-stop FSS using a single-layer topology in which each band can be positioned independently.

If the desired frequency selectivity of a surface is known, equivalent circuit techniques can be used to develop a periodic FSS pattern which will have resonances occurring at the required frequencies. Conductive strips and gaps aligned with the electric field act as inductances and capacitances, respectively. Hence, with careful design of the geometry, multiple LC paths can be created in the direction of the incident electric field to resonate at the required frequencies. The design can be made to have rotational symmetry to ensure polarization independence, however, due to space constraints in a single-layer design, it is difficult to achieve equal bandwidths in each stop band. In our design we use edge-coupled conductive strips and interdigitated intermediate structures to produce the required transmission characteristics of the FSS with large bandwidths in both stop bands and a zero half way between the poles.

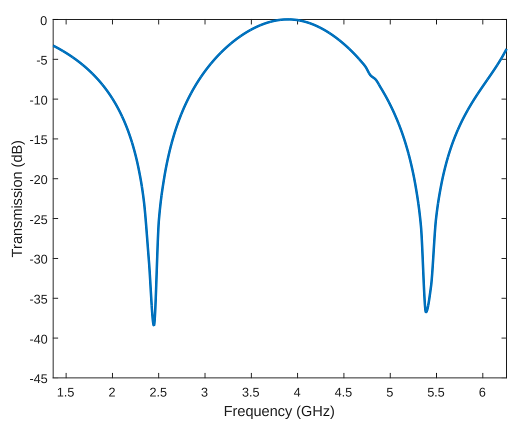

Figure 1: FSS transmission characteristics

Our single-layer FSS design exhibits a primary pole at 2.45 GHz with a -10 dB bandwidth of 33.3% and a -20 dB bandwidth of 10.3% and a secondary pole at 5.38 GHz with a -10 dB bandwidth of 16.5% and a -20 dB bandwidth of 5.6%. The intermediate zero is at 3.92 GHz. The -20 dB bandwidths have an absolute value of 250 MHz and 300 MHz respectively. Furthermore, each resonance is easily adjustable by tuning a corresponding geometric parameter.