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Planar Tri-Band Frequency Selective Surface with Transmission in S-Band and Reflection in Ka/Ku-Band[1]

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Abstract—In this paper a novel low-profile single-layer tri-band frequency selective surface (FSS) unit-cell, which consists of dual concentric modified circular ring, is analyzed and simulated. It can be utilized in the satellite communication systems and electromagnetic shielding applications. The proposed structure has been developed using the modifications in the concentric circular rings FSS in order to obtain the significant percentage of fractional bandwidth and stable frequency response for the perpendicular (*TE*) and parallel (*TM*) polarized waves for incidence angles up to 50°. We have also compared the polarization and angular stability performance of the proposed FSS structure with that of the another reported in the literature.

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1. INTRODUCTION

Frequency selective surface (FSS) is a periodic structure composed of one or two-dimensional lattice, which operates as an analogue spatial filter and it is extensively used in the satellite communications, radomes, missiles and electromagnetic shielding applications [1]. There is a potential need to develop FSS structure with multiband frequency characteristics to fulfill the increasing demands on multi-functionality of antennas and filters for the next generation communication/detection applications [2, 3].

There are various approaches to yield the multiband frequency response such as layered/stacked FSS [4, 5], fractal/convoluted FSS [6–9], perturbation of a single-layered FSS [10], multi-resonant element FSS [11–14], and combination of these approaches [15].

The layered/stacked FSS structures provide significant frequency response over a wide range of the angle-of-incidence (AOI) and polarizations of the incident wave. Nevertheless such structures are complex, heavier in weight, larger in volume and expensive, as it is discussed in [4, 5]. In addition to this, the fractal/convoluted FSS structures also have been investigated, but these structures require high degree of iterations and difficult to manufacture [6–9]. Hill and Munk [10] have designed a single layer dual-band FSS structure using the perturbation technique, whose frequency response is very sensitive to different polarization states of the incident wave.

For the satellite communication applications, a simple, light weight, low profile FSS structure is the prime demand, which is achieved using the FSS structure with multi-resonant elements [11–13].

Earlier, the researchers have discussed the multi-resonant element FSS structure using the classical geometrical shapes such as concentric circular ring FSS, which is also very sensitive to the AOIs [11]. In [12], a dual-layer (single and double screen) circular ring FSS structure has been discussed, which reflects electromagnetic waves of X-band frequencies, as well as transmits the electromagnetic waves of

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