Regular Gratings of Planar Strips as High Impedance Surfaces

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An artificial high-impedance surface is an engineered metal-dielectric structure having the properties of magnetic walls. Over a finite frequency range, it is possible that the high-impedance surface behaves like a perfect magnetic conductor. The electric field reflection coefficient of normal incident electromagnetic wave equals +1 at the resonance. Far from the resonance the reflection coefficient is close to -1, and the artificial surface behaves as an ideal metal screen coated by a thin dielectric layer. These properties of artificial magnetic walls are very useful in the microwave and antenna techniques, extending the design space. Artificial high-impedance surfaces allow many applications such as new ground planes for novel low-profile antennas.

So called “space-filling curves” are known. The periodic array of wire particles having the form of the Hilbert curve and placed over a ground plane was proposed as a high-impedance surface [1]. Another way to realize artificial magnetic coatings is to use an array of small dipoles loaded by inductances [2].

In the present study, we have been interested in exploring new variants of high-impedance surfaces. The microstrip double periodic grating of infinitely long wavy strips is an example of such very thin structures. The resonant reflection properties of periodic gratings of wavy metal strips in free space were studied in [3]. The aim of this paper is to present the resonant properties of planar gratings of wavy microstrip lines in view of possible applications as artificial high-impedance surfaces. Due to a complex shape a narrow strip particle can have stretched length much longer than the size of the periodic structure cell. This way one can obtain thin microstrip arrays of complex shaped particles having resonant wavelength much longer than the lengths of the array periods and clear demonstrated bright properties of high-impedance surface [4, 5].

To control artificial magnetic coatings it is convenient to use electron devices included in each cell of the microstrip grating. The properties of the grating may be controlled by bias currents flowed in uninterrupted grating elements loaded by control electron devices. Thus, a periodic coating with uninterrupted elements as wavy strips may be useful for some applications.

The reflection properties of these microstrip periodic gratings are studied and analyzed and potential applications discussed.

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