Miniaturization Strategies for Soft/Hard and High Impedance Surfaces Design at Microwaves Frequencies

L. Inclán-Sánchez, J.J. Sáenz

Departamento de Física de la Materia Condensada
Universidad Autónoma de Madrid. E-28049, Madrid. Spain. (*luis.inclan@uam.es*)

In this paper, novel soft/hard and high impedance surfaces based in new geometries are presented. We analyze the properties of surface wave propagation through these structures made of printed modified strips. The new shapes for the strips are the coupled lines topology and the spiral one, both are provided with metalised via holes in a lateral position. The size reductions for new shapes when compared with strip-loaded surface are 14% and 23% respectively. The presented structures are very suitable to improve efficiency and to reduce mutual coupling in antenna applications.

Periodic structures have received much attention in antenna applications during the last years. Very interesting case are the soft and hard surfaces. The basic implementations of these surfaces are corrugations in a metal plate or metal strips (Fig. 1) on a grounded dielectric slab [1]. Miniaturization of microwave components and antennas has become increasingly important in recent years [2][3][4]. In this paper miniaturized horizontal corrugations and miniaturized EBG elements, based on new topologies for the strips, are investigated. The work shows how a reduction in size can be achieved by taking advantage of the impedance transformation related with the new shape [3]. Different shapes are proposed including a coupled lines structure and a spiral shape. In the two cases the forbidden frequency band moves towards lower frequencies. These modified planar corrugations are composed of novel topologies for the strips and vias that connect the strip with the ground plane. These new structures achieve a size reduction compared to conventional horizontal corrugations and elements. A numerical characterization of the new topologies and its stop band behaviour is described in the paper.

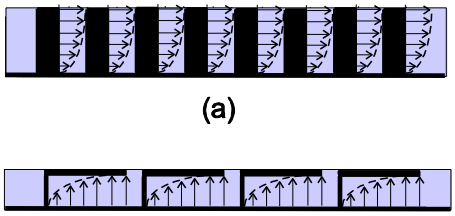

Fig. 1 Different realisations of soft surfaces. (a) Classical transverse corrugations. (b) Horizontal Corrugations

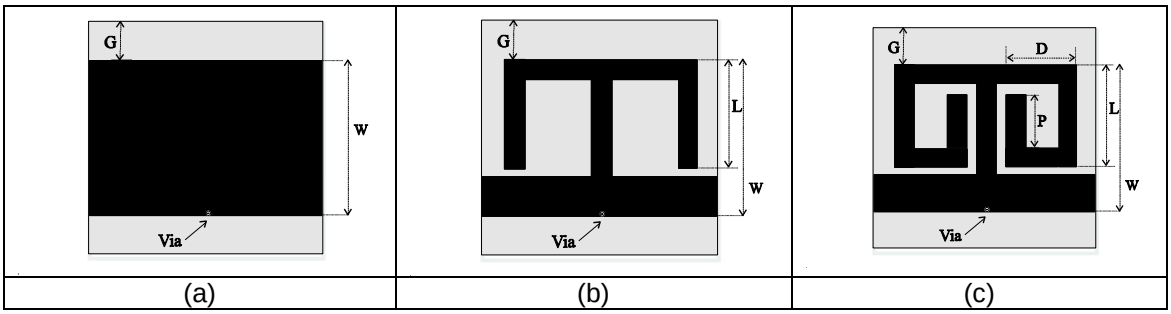

Fig. 2 Geometries of the studied surfaces. Strip-loaded with vias (a).Coupled lines shape (b). Spiral line shape (c)

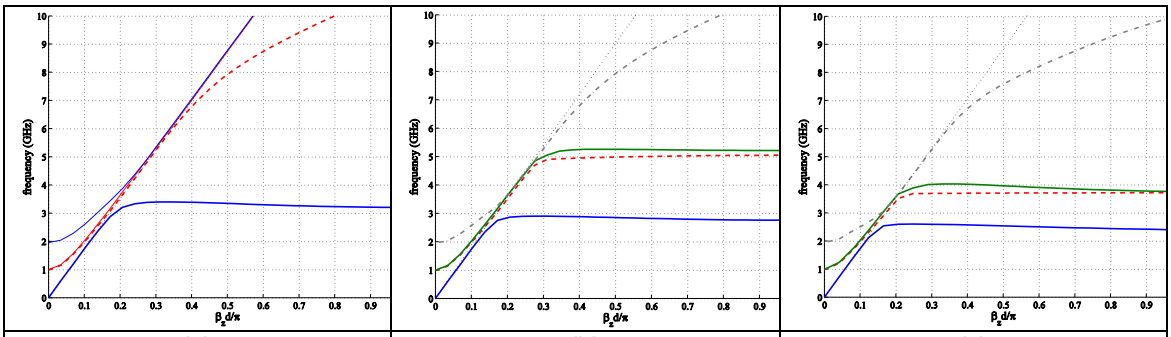

Fig. 3 Dispersion diagram for : (a)horizontal corrugations with vias. (W=λ_ε/4, G=0.1λ_ε, ε_r=4.4). (b) Coupled line shape. (W=λ_ε/4, G=0.1λ_ε, L=7W/10, ε_r=4.4). (c) Spiral shape. (W=λ_ε/4, G=0.1λ_ε, L=7W/10, P≈4W/10, ε_r=4.4)

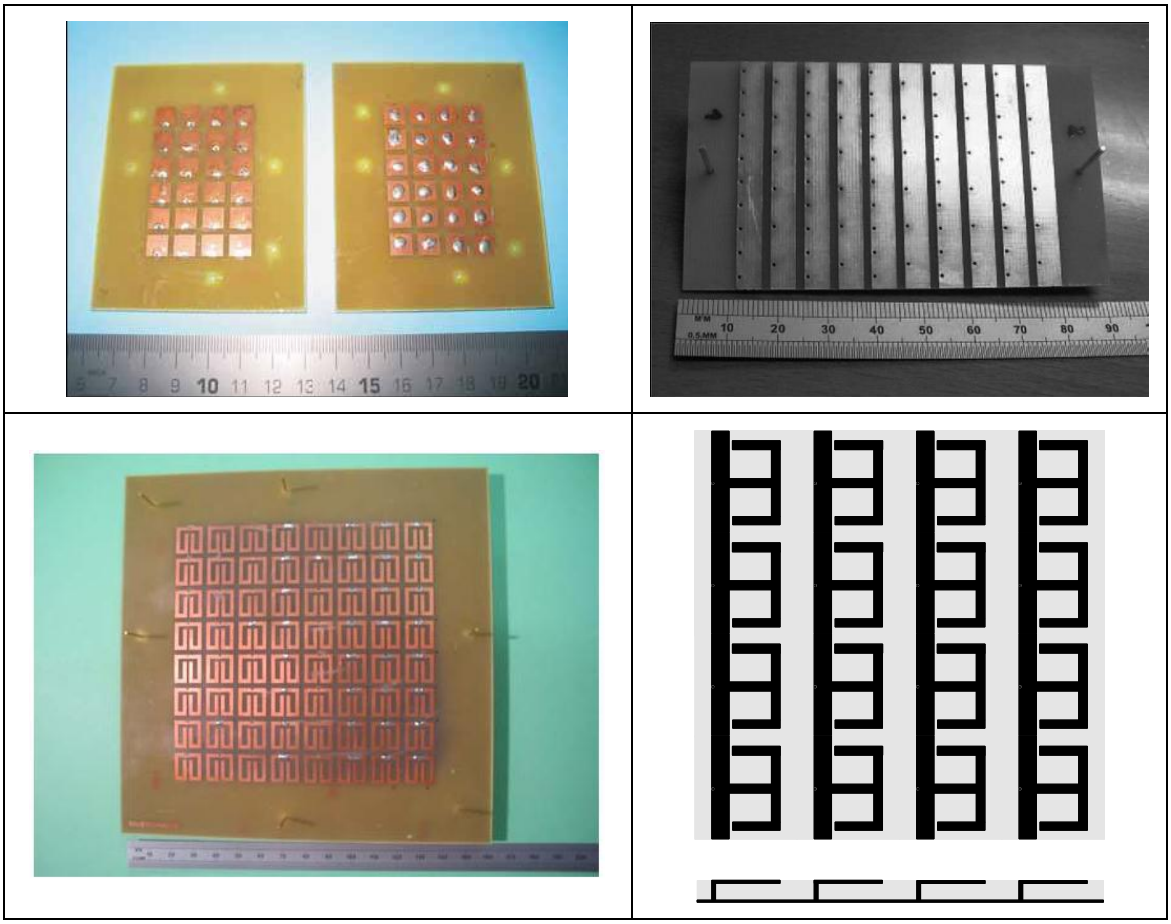

Fig. 4 Different realizations of Soft/Hard and High Impedance surfaces

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