Size-reduction using strip-type soft surfaces rather than patch-type EBGs

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Soft surfaces have a common feature with electromagnetic bandgap (EBG) surfaces: they have frequency bands where wave propagation along the surface is not allowed, i.e. they have bandgaps *(Kildal, Maci and Kishk, IEEE Trans. on Ant. and Prop. vol. 53, pp. 27, Jan. 2005)* . However, the main difference between them is that soft surfaces have this property only in one direction of propagation whereas EBG surface have that bandgap for all directions in a plane. Nevertheless, there are many applications where we have a clear direction of interest to suppress wave propagation. In such cases, soft surfaces have the additional advantage that they cancel both vertically and horizontally polarized waves.

Planar EBG surfaces can e.g. be realized by periodic arrangement of metal patches on a grounded dielectric substrate, where the patches are grounded with via holes *(Sievenpiper et al. IEEE Trans. Microwave Theory and Tech., vol. 47, pp. 2059-2074, Nov. 1999)*. The corresponding soft surface would be a periodic arrangement of metal strips rather than patches, with periodically located via holes along the strips. In the present work we have computed the bandgaps of both patch-type EBG surfaces and strip-type soft surfaces. The work includes a complete parametric study including permittivity, gap size, thickness and vias period and position. The results show that the patch-type EBG and strip-type soft surface have an almost coincident bandgap. However, in the case of strip-type soft surface we have an extra parameter to play with, namely the via period. By varying this a further reduction in element size can be obtained. This allows us to conclude that the width of the strips of the strip-type soft surface can be made smaller than the width of the patch of a patch-type EBG, for similar performance.

We also found that if the via position for both structures (soft and EBG) is moved from the center to the edge, the bandgap appears at lower frequencies, which also reduce the element size.