Embedded-circuit Meta-materials for Surface Wave Suppression

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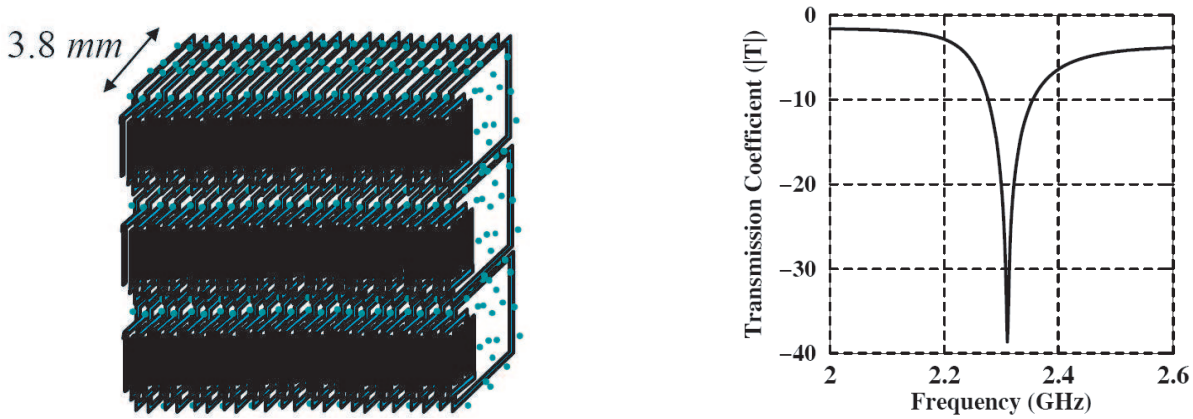
Suppressing surface waves is a very challenging task in electromagnetics. Many researchers have proposed different configurations to stop the surface wave propagation. One of the most efficient ways has been based on the use of periodic dielectric and metallo-dielectric Electromagnetic Band-Gap (EBG) structures [1–2]. However, the periodicity of such structures is comparable to the wavelength and at least a few periods are required to achieve high isolation which is not very appropriate in the design of small size devices and systems.

In this paper a novel approach based on negative μ materials for suppressing the surface waves is offered. To accomplish this, Embedded-Circuit Loops (ECL), realizing artificial molecules, are printed on a low dielectric material. For a magnetic excitation polarized along the axis of the loops, the designed meta-material presents negative permeability property. In the negative μ region, the wave is stopped and cannot penetrate through the material [3]. Unlike traditional EBGs the periodicity of ECL can be a very small fraction of a wavelength ($< 0.05\lambda$). Fig. 1(a) depicts the geometry of a 1-layer ECM. The transmission coefficient for a plane wave illuminating a very thin layer of a ECM is shown in Fig. 1(b). The stop-band behavior is clearly demonstrated.



(a) (b)

Figure 1: (a) Embedded-Circuit Metamaterial and (b) its performance.

REFERENCES

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