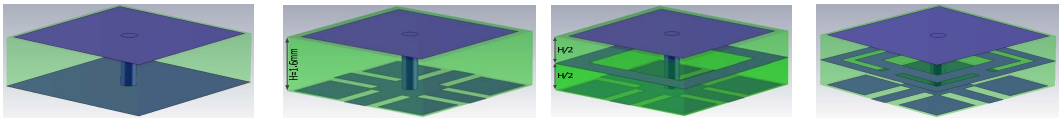
A Compact Dual-layer Electromagnetic Bandgap (EBG) Structure

Huynh Nguyen Bao Phuong*[(1)], Tran Minh Tuan [(2)], and Dao Ngoc Chien[(3)]
[1]Hanoi University of Science and Technology, Hanoi, Vietnam
[2]Ministry of Information and Communications of Vietnam, Hanoi, Vietnam
[3]Ministry of Science and Technology, Hanoi, Vietnam

Several of compact Electromagnetic Bandgap (EBG) structure was proposed in the literature. In these structures, the size reduction was achieved by increasing either equivalent capacitance or equivalent inductance. In this paper, a compact dual-layer EBG structure was proposed by producing of both additional capacitance and parasitic capacitance. Therefore, the proposed EBG structure exhibit the cell size reduction of about 62% in comparison with the conventional mushroom-like EBG.

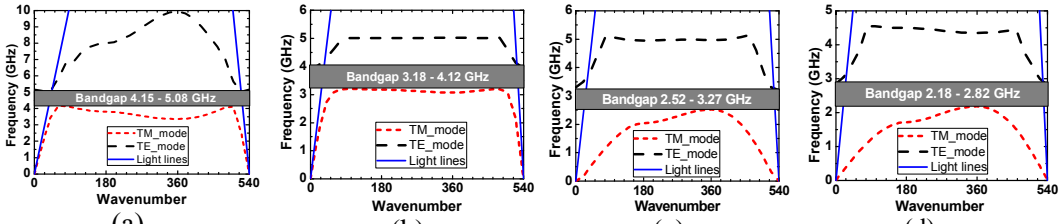
The proposed structure is designed in three steps. In the first step, the metal ground of the conventional EBG was replaced by the ground that has the shaped like-uniplanar compact EBG surface. The capacitance C_{LP} and the inductance L_{LA} will be added to the total capacitance and total inductance of the EBG-Step1, respectively (see Fig. 3b). Hence, the resonant frequency of this structure is moved to the lower region frequency (see Fig. 2b). In the next step, a metal square ring was embedded in the middle of the substrate layer. The coplanar capacitance C is formed (see Fig. 3c). Therefore, the resonant frequency of the EBG-Step2 structure is more reduced than the one of the EBG-Step1. Finally, the EBG-Step3 is formed by etching four L-shaped slots on the metal square ring. As results, the parasitic capacitances C_P are produced (see Fig. 3d). The resonant frequency of the EBG-Step3 is more reduced than the one of the EBG-Step2.

The comparison between the proposed EBG structure with different EBG structures have been done. It demonstrates that the proposed structure achieves the excellent in size reduction.



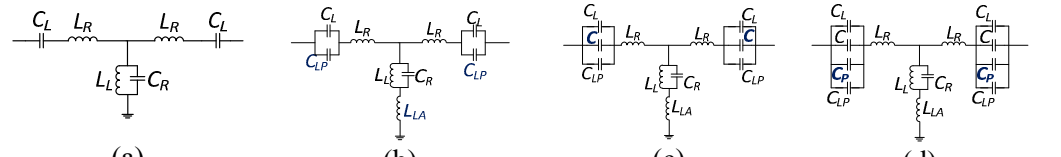
(a) (b) (c) (d)

Figure 1. EBG structures: a) Conventional mushroom EBG, b) EBG-Step1, c) EBG-Step2, and d) EBG-Step3.



(a) (b) (c) (d)

Figure 2. Simulated results of dispersion diagram: a) Conventional mushroom EBG, b) EBG-Step1, c) EBG-Step2, and d) EBG-Step3.



(a) (b) (c) (d)

Figure 3. Equivalent circuits LC: a) Conventional mushroom EBG, b) EBG-Step1, c) EBG-Step2, and d) EBG-Step3.