Optimizing Microwave Bandgap Filter Structures by Minimizing Radiation-Loss

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Abstract

Defected Ground Structures (DGS) become very interesting options for filter implementations as the bandgap effect ensures a single-pole (Butterworth-type) filter over wide frequencies. A less known characteristic of DGS is that the slot etched in the ground plane works as a radiator (antenna) giving rise to unwanted energy coupled to nearby components at frequencies beyond resonance. In this work, for the first time, the approach of minimal radiation-loss is introduced to develop a new bandgap cell based on the Defected Microstrip Structure (DMS) concept; a microstrip defect is included in the ground plane to further disturb the shield current distribution. The complementarity between the DGS and DMS cells is evaluated in a new unit structure that maintains the single pole response of DGS while providing better grounding and diminished radiation losses. Full-wave electromagnetic simulations were achieved to allow investigating of the grounding and radiation effects; density current distributions and induced fields in the etched defects are carefully studied using electromagnetic modeling. Unwanted couplings are reduced improving the filter response specified by lumped circuit models. Through measured prototypes, the proposed cell scheme was analyzed confirming frequency responses with improved attenuation levels.

References

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