Abstracts

Design consideration for modeless integrated circuit substrates using planar periodic patches

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In recent years, there has been significant interest in complete surface-wave elimination (meaning in all possible directions) through the use of periodic elements incorporated into integrated circuit structures. However, to date there is no comprehensive theory for the design of the surface-wave bandgap, and it also appears that leaky modes with complex propagation constants that may exist on the planar periodic structures have not been properly taken into account. As shown here, fast periodic leaky modes may exist within a surface-wave bandgap zone. These leaky modes may result in more energy loss and crosstalk than the surface-wave modes and should be taken into account in circuit design. This paper presents theory and experimental validation for guided surface-wave and leaky modes on a printed circuit structure consisting of planar periodic metal patches over a grounded substrate. The existence of surface-wave bandgaps and leaky modes is attributed to either element resonances or the weakly bounded dielectric slab modes. It is also found that fast periodic leaky modes may exist within a surface-wave bandgap zone. Design procedures for achieving a complete surface-wave bandgap without leaky-modes are outlined and examples are given.

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