Multistrip Coupler Modeling: Normal Modes Decomposition

Abstract

This lecture discusses multistrip coupler (MSC) modeling using normal modes decomposition. The core idea of the modeling approach is decomposition of the wave pattern into symmetric and antisymmetric modes. In particular, the lecture presents and compares several MSC models and their practical implementation.

Two-Mode Decomposition in MSC Modeling

The lecture assumes two rectangular orthogonal modes with symmetric and antisymmetric amplitude distributions (two-mode decomposition) propagating across the MSC. Physically, these symmetric and antisymmetric modes correspond to acoustic waves propagating with two different SAW velocities in open- and short-circuit periodic SAW gratings, respectively. Consequently, known techniques for modeling non-reflective and reflective gratings can also be applied to normal-mode MSC analysis. Furthermore, MSC scattering parameters can be expressed in terms of modal scattering parameters using acoustical boundary conditions.

Normal-Mode Representations for MSC Modeling

In particular, the lecture derives normal-mode solutions using several different techniques:

1) in the quasi-static approximation (neglecting SAW reflections near the MSC synchronous frequency)
2) reflective array model (RAM) based on the closed-form cascading of the elemental reflective cells
3) coupling-of-modes (COM) analysis
4) field approach based on the closed-form equations for the fundamental and first backward space harmonics.

MSC properties both in the passband and stopband are discussed. Simulation results are compared with the published results and experimental data.

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