Abstracts

Frequency-Domain Solution for Coupled Striplines with Crossing Strips (Short Papers)

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In this paper we present a frequency-domain approach to the modeling of the propagation of short-rise-time digital pulses along groups of coupled striplines which are overcrossed or undercrossed by orthogonally positioned signal conductors on adjacent signal planes in a high-density circuit board or multichip module substrate. Although this "crossing strip problem" has been described previously, most recently in a contribution by Gu and Kong, the solution presented here has several completely new features which are important in the application of this method to real-world modeling problems in the following ways: First, the new solution significantly simplifies the mathematical formulas which sum the multiple reflections and crosstalk components with the primary digital pulse to generate the final waveform conformations on the multiple conductors (four pages of equations in [1] are reduced to only 16 lines). As a result, this method is much easier to implement than earlier techniques, especially as a software kernel for a computer-aided design tool. The method presented here also reduces the central processing unit (CPU) time needed to execute these solutions by a nontrivial factor of 2-3 in comparison with the earlier method presented by Gu and Kong. Second, the new method removes the earlier constraint that the crossing strips on the orthogonal signal layer be uniformly spaced; that is, nonuniformly spaced crossing strips are now supported by the mathematical derivation. Third, the new derivation allows for nonideal (i.e., "real-world") voltage sources, in contrast to methods described previously (e.g. [1]), which have permitted only ideal step and ramp signals to be directly applied to the signal nets.

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