

Relative Convergence Problem in the Mode-Matching Analysis of Stripline Interdigital Filters with Different Input-Output Coupling

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Interdigital filters are used in microwave frequencies by their wide spurious-free response and their highly symmetric frequency response, which can be used to design filters with very flat group delay. They are TEM mode filters made up of a number of metallic rods or strips enclosed by a box and positioned consecutively along z -direction (see Fig. 1). The input/output of the filter can be transversal (Fig. 1.a) or longitudinal (Fig. 1.b) to the resonating strips, depending on the required interfaces and filter bandwidth.

The approximate design of interdigital filters is found in *Matthaei et al.* classic book (*Microwave Filters, Impedance-Matching Networks and Coupling Structures*, Artech House, 1980). A full-wave analysis method is required in order to take into account parasitic effects of the physical implementation such as the coupling between non-adjacent lines or the enclosure box.

This communication addresses the Mode-Matching analysis (MM) of the structures in Fig. 1, which is applied as follows. Firstly, the structure is segmented into a number of uniform waveguides along a specific direction (x in Fig.1.a and z in Fig. 1.b), whose TE, TM and TEM mode spectrum can be calculated either analytically or numerically. Secondly, the Generalized Scattering Matrix (GSM) that characterizes each basic step between two consecutive waveguides of different cross sections is calculated. Finally, all the individual GSMs are cascaded adequately to obtain the overall filter response.

Although this procedure is applied to the configurations in Fig. 1, its implementation leads to significant numerical differences for the structures with perpendicular (along x) and longitudinal (along z) excitation. Basically, the analysis in Fig.1.a involves TEM^x modes, which model the total field in the structure adequately. However, the field in the resonators in Fig.1.b is obtained by summing up TE^z and TM^z modes, which leads to convergence difficulties. The results of the investigated relative convergence problems [T. Itoh, *Numerical Techniques ...*, John Wiley, 1989] will be shown in the oral presentation.

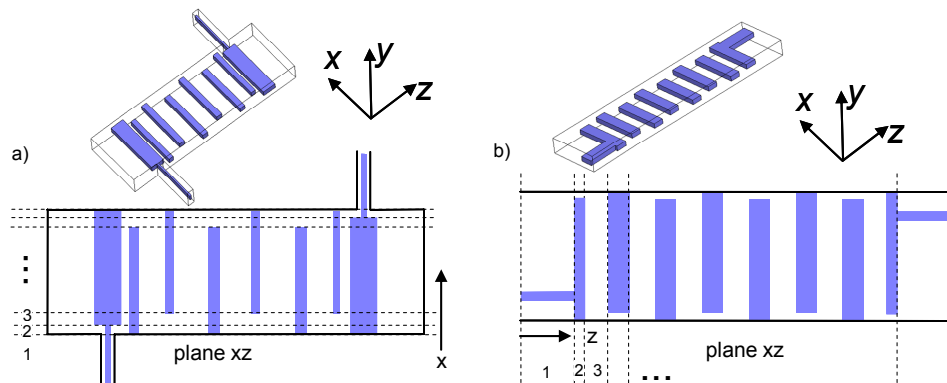


Fig. 1. Interdigital stripline filters with transversal (a) and longitudinal (b) input-output coupling.

