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FULL-WAVE SPECTRAL DOMAIN ANALYSIS OF OPEN PLANAR CIRCUITS AND ANTENNAS

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Passive planar microwave circuits and planar antennas are essential components of electronic communication systems utilising the microwave region of electromagnetic spectrum. As the frequency increased upto unused frequency bands with more available bandwidth, the simplified circuit theory, which is valid at low frequencies, can not simply be employed for the analysis of the microwave circuits of interest. Therefore it is necessary to use full–wave numerical techniques ans the Spectral Domain Method, which is widely used in the literature, has been chosen to meet this requirement. SDM requires definition of the current distribution on the metallisation and repeated calculation of the impedance matrix for each frequency point of interest. The purpose of this paper is to speed up the calculation of the impedance matrix for open planar structures.

The first step of the analysis is to expand the unknown current distribution as a set of known basis functions with unknown coefficients. The choice of basis functions is crucial to the efficiency of the technique and special care must be taken to approximate the unknown current distribution as closely as possible. The use of pre–calculated basis functions reduces the impedance matrix to be calculated. But, the pre–calculated basis function introduced by Railton (C.J. Railton and S. A. Meade, *IEEE Trans. Microwave Theory and Tech.*, 978–985, 1992) has limitations such as identical sub–domain basis function sizes which are used to pre–calculate the function. Moreover the number of sub-domain basis functions plus 1 must be the power of 2 to exploit FFT. These restrict the geometry of the circuit. Since the FFT is not available for open structures, the pre–calculated basis function is defined as a combination of sub–domain basis functions, which are functions of their locations or a current wave wi th pre–calculated propagation constant.

The location vector calculation, which reduces the number of impedance matrix elements, is introduced and used in the region where identical sub–domain basis functions used. For this region, a sub–domain basis function is divided into two parts. First one is identical for each function and second one represents its location. By this enhancements, N(N+1)/2 number of impedance matrix elements calculated are reduced to 3N, where N is the size of the impedance matrix. In addition, the asymptotic form of the Green's function, which is defined for large values of transform variables, is used to calculate the impedance matrix.

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