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# MATHEMATICAL BASIS OF A SYSTEM SUPPORTING INTERCONNECTION DESIGN

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Abstract. A software system is constructed for the computation of characteristic model parameters of multi-conductor strip and microstrip lines which are needed in design of high-speed packaging and Very Large Scale Integration (VLSI) interconnections. New mathematical algorithms are developed which assure high accuracy and an excellent computational efficiency. Three major mathematical improvements are presented in this paper: (1) a new matrix square root algorithm which is used in computing an admittance matrix; (2) a new matrix algorithm based on the theory of M-matrices which provides monotonic global convergence to the exact solution in calculating a diagonally matched load impedance matrix of transmission lines; and (3) a multi-dimensional cubic spline algorithm which is used in computing intermediate values from the database of transmission line parameters. Model parameters of transmission lines are stored in a database, which can be used to determine a proper transmission line structure for a set of desired line electrical characteristics. Databases for three and five conductor transmission line systems were constructed. It was found that five conductor systems can effectively represent the seven, nine or more conductor systems for most practical applications. Use of a special spline interpolation in our algorithms involving interconnection database resulted in a substantial reduction of database size, in comparison to algorithms with linear interpolation without compromising accuracy. Consequently, computer time needed for calculations involving database is also significantly reduced. The expert system has special importance in repeated applications and in cases when several design alternatives have to be considered.

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