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# Solution of eigenproblems for state-space transient analysis of transmission lines

Mehmet Salih Mami   ... Muhammet KÃ¶ksal

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## Abstract

When lumped parameter models are used for transmission lines, which are originally distributed parameter systems, the set of first order ordinary differential equations (ODEs) of the lumped parameter equivalent circuit can be arranged so that the coefficient matrix is in the tridiagonal form. In the circuit theory, these equations are called as state-equations and in the analytical solution of these equations computation of matrix exponential takes an important part. One way to calculate the matrix exponentials and other matrix functions is to use similarity transformations, which requires eigenanalysis of the coefficient matrix. In this study, state-space technique for computation of transmission line transients is given. Calculation of matrix exponentials for coefficient matrices having tridiagonal structures and eigenproblems associated with it are investigated. QR algorithm, LR algorithm and characteristic equation method for eigenvalue calculation are treated for this type of matrices in both accuracy and

computer run time point of views. Several cases are considered and effect of matrix dimension and ill-conditions are also examined.



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## Keywords

State-space technique; Eigenproblems; Transmission line; Transient analysis

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