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METHEE HWANGKHUNNATHAM : AN ACCURATE TIME DOMAIN COMPANION MODEL OF A LOSSY TRANSMISSION LINE. THESIS ADVISOR : ASSOC. PROF. EKACHAI LEELARASMEE, Ph.D., 88 pp. ISBN 974-17-0104-7.

This thesis presents two new transmission line models for time domain simulation of transmission line circuits, i.e. a two level transmission line model and a time domain companion model. The first model is based on lumped discretization in which the transmission line is replaced by an N segments of lumped R,L,G,C components. This model can avoid the simultaneous solution of a large number of variables by computing an equivalent macromodel of each transmission line that has no internal nodes and splitting the analysis into two levels. The first level deals with a normal circuit analysis in which each transmission line is replaced by its equivalent macromodel while the N-Segmented model of transmission line is analyzed at the second level to update the equivalent macromodel at each timepoint. This latter analysis can be done efficiently using a set of recursive formulae whose complexities depend linearly on N. The second model is a novel model obtained by applying the numerical differentiation formulae directly at the telegrapher equation to obtain a first order differential equation with respect to the distance parameter. This time discretized spatial differential equation can be solved analytically to give a true time domain companion model of the transmission line whose state variables are the spatial distribution of its voltages and currents. To cope with the computational complexity in storing and updating these distributions, a piecewise exponential approximation is used. With this model, the timestep selection and accuracy of approximation can be chosen to control the local truncation error of the time domain simulation.