Transient Analysis of High-Speed Interconnect Networks

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This thesis describes the efficient methods to simulate transient responses of high-speed interconnect networks. The analysis of interconnect networks is one of the most important issues in VLSI circuit design. In high speed digital and analog systems. After the introduction, in chapter 2, the generalized method of characteristics (GMC) is reviewed, which replaces a lossy transmission line with an equivalent disjoint network. Next,the generalized line delay window (GLDW) partitioning technique is proposed, which accelerates the transient analysis of the circuits including transmission lines replaced by GMC model. In chapter 3, an efficient method to simulate lossy coupled transmission lines based on the delay evaluation technique is proposed. This mathod enables to obtain the accurate transient waveforms using smaller number of moments than the other moment methods use, and is modified for acceleration by the gener-alized line delay window partitioning (GLDW) technique. In chapter 4, the expanded generalized method of characteristics (GMC)in order to handle large linear interconnect networks is proposed. This method computes a characteristic impedance and a new propagation function of the large linear networks containing many transmission lines. Simulation results show that the proposed method can simulate efficiently and accurately transmission line networks. In chapter 5, an efficient synthesis technique of the time-domain models for interconnects having 3-D structure using FDTD method is proposed. Once the proposed time-domain model is synthesized, we can avoid the enormous FDTD simulation. In chapter 6, the conclusions of this thesis are described.