11:15-11:30 [8]

Macro Models and Algorithms for High-Speed Simulation of Bipolar Mixed Analog-Digital Circuits

Toshio Shimmi, Susumu Inohira, Minoru Nagata,
Kyoichi Iida[+] and Shinji Itoo[++]
Central Research Lab. and [+] Takasaki Works, Hitachi Ltd.
[++] Hitachi Microcomputer Engineering Ltd.

ABSTRACT

We propose new macro models for I^2L gates and new algorithms for mixed mode simulation of bipolar analog-digital circuits with large-scale I^2L circuits. The I^2L macro models consist of voltage sources, resistors, capacitors, and switches. The switches are controlled by input voltages and threshold values. In the macro models, the accurate output waveforms are obtained by switching between two resistors values. Circuits are designed with analog and digital parts, and these parts are automatically connected by adding current sources and resistors to the nodes at analog-digital interfaces. While the analog parts are analyzed by a well-known modified nodal method, digital parts are analyzed by a timing simulation method, using the macro models. Both solutions are well connected at each time step in our algorithm. Accurate simulation is maintained by using precise device models for analog parts. Application of the models and the algorithms to analog-digital mixed mode simulation of tracking monomulti-circuits for a video casset recorder is demonstrated. The execution time for the analog-digital mixed circuit with feedback is 5 times faster than the conventional circuit simulation. Execution times for pure digital circuits with 10 to 50 gates such as flip-flops are 10 to 100 times faster than the conventional simulations.