Monte Carlo Simulation With Hspice and Sue

I. Background

Monte Carlo simulation is a method of simulation with unknown variables. In Monte Carlo simulation values for unknowns are randomly selected according to their statistical distribution. The process is repeated for a number of simulation runs, each with a new set of values for the unknowns. The distribution of the final results is taken to be representative of the behavior over the range of inputs.

II. Applications in circuit simulation

Monte Carlo simulation is a popular method of dealing with the large number of correlated and uncorrelated variables involved in circuit design. Process parameters can be characterized as a distribution of transistor behaviors giving the designer a large amount of data to deal with. Monte Carlo simulation allows all of these variables to be considered during simulation. Monte Carlo simulation is frequently used to give inputs to statistical timing software or to predict circuit yield and sensitivity.

III. Monte Carlo simulation with Hspice

Hspice supports Monte Carlo simulation through most of its simulation capabilities. For our applications we are interested in the support offered during transient simulation. To enable Monte Carlo simulation as part of transient simulation the following code is appended to the .tran card : *sweep monte=#* where # refers to the number of simulation runs to be performed.

In order for Monte Carlo simulation to actually change values in your spice deck the values to be changed must be specified. Parametrized distributions are very similar to straight parameters. Instead of simply declaring *.param x = y* the declaration looks like *.param x=agauss(avg,deviation)*. Each time this parameter is referred to a new value is chosen for it.

IV. Monte Carlo simulation with Sue

Since sue is merely a schematic capture software the actual simulation is relegated to Hspice. We have provided sue files on the website that allow you to access the .tran and .param cards from within sue. To use these cards, download them from the website and place them in the same directory as the sue file you are working with. The card is interacted with in the same manner as any other schematic element in sue: double click to edit the properties. If you plan on using these cards it is wise to remove the .tran card from your header as well as any .param card you intend on manipulating from Sue.

V. File Sizes

Monte Carlo simulation basically causes a large number of discrete simulations to occur. The files containing simulation results may become very large. It is important that you keep an eye on how much hard disk space you are consuming. If you exceed your quota Hspice and other software may stop functioning. Consider using *.option probe* and *.probe*. *.option probe* restricts the output file to only containing data mentioned in the *.probe* statements.