EECS 141 Fall 1999 **Discussion Session** Week #1 9/1/99

Tips for using Hspice

I. Getting Started

- Setup the environment:
  source /usr/eesww/HSPICE/98.2/bin/cshrc.meta
- Run the simulator on your input file:
  hspice filename.sp >! filename.lis
- Use the waveform viewer to see the output
  awaves
  Input files must have the extension *.sp* for the waveform viewer to work.
  Also, the input file must have ".OPTION POST=2" specified.
  Waveforms can be printed by choosing Tools -> Print...
- View the online documentation
  acroread /usr/eesww/HSPICE/98.2/docs/hspice.pdf &
  The page numbers in the rest of this document refer to this manual.
  This file is 11 MB (1714 pages). Do not print it out!

II. Netlist Format

- The input files are case insensitive.
- The first line is always a comment. Other lines are commented with a leading * or $
- All nonlinear devices must have a .MODEL statement.

Names:
- can contain letters, numbers, and the characters ! # $ % * + - / < > [ ] _ (see p. 3-18)
- can be 1024 characters long
- Node names can begin with letters, numbers, or the characters # _ ! % (see p. 3-19)
- Trailing alphabetic characters are ignored in net names. For example a node named 1A is considered to be equivalent to node 1 (see p. 3-19)
- Nodes named 0, GND, GND!, and GROUND all refer to the global ground node.

III. Values

Expressing Values:
- Scientific notation: *e.g.* 1.1e-17
- Use a suffix: *e.g.* 2.3u (x=mega, k=kilo, m=mili, u=micro, n=nano, p=pico, f=femto)
- Use a parameter: *e.g.* minlen (parameters must be declared with a .PARAM statement)
- Evaluated expressions: *e.g.* '500m*minlen'

Output variables:

- Voltage between two nodes: v(n1,n2)
- Voltage of a node relative to ground: v(n1)
- Current through an independent source: i(vin)

IV. Analysis

- .OP Operating point, DC circuit solution (see p. 6-8)
- .DC Sweep of DC operating points (capacitances are ignored) (see p. 8-1)
  .DC var startval stopval incr - performs a DC sweep on the independent source or parameter **var**, varying its value from **startval** to **stopval** using the increment **incr**.
- .TRAN Perform a transient analysis (differential equation solver) (see p. 7-1)
  .TRAN tincr tstop – finds the operating point (.OP) and then performs a transient analysis of duration **tstop** seconds with a maximum time step of **tincr**.

V. Control

- .INCLUDE – includes a file (see p. 3-60)
- .OPTION – sets simulation options (see p. 3-45)
- .END – marks the end of an input file
- .ALTER – treated as .END, but allows another simulation to be performed with the changes that follow the .ALTER statement (see p. 3-34)

VI. Measurements

- **.MEASURE TRAN t_delay TRIG v(in) VAL=2.5 CROSS=1 TARG v(out) VAL=2.5 CROSS=1**
  Measures the propagation delay between the nodes in and out, where the signals first cross 2.5 volts.
- **.MEAS t_rise TRIG v(out) VAL=0.5 RISE=1 TARG v(out) VAL=4.5 RISE=1**
  Measures the first 10%-90% rise time of a 5V signal
- **.MEAS TRAN max_current MAX I(Vdd)**
  Measures the maximum current through the independent source Vdd
- **.MEAS peak_power PARAM='max_current*5'**
  Calculates the peak power, assuming that max_current has been measured

Measured values are placed in a file called ***filename*.mt#.** See p. 4-19 for more details.

VII. Troubleshooting

- **Failure to converge** (OP and DC) – The DC solver uses an iterative method to find the operating point, but some circuits exist which have no or multiple operating points. The best solution is to perform hand analysis of your circuit to make sure that you haven't done this.

- **No DC Path to ground** (OP and DC) – This often happens with floating MOSFET gates. Just add a resistor between the node and ground, or use the .IC or .NODESET commands to create an initial condition. Be warned, however, that .NODESET and .IC can cause convergence problems.
- **Stability Problems** (TRAN) – Sometimes a transient analysis shows a "ringing" or oscillation that shouldn't be there. This can often be solved by reducing the maximum time step or using slower rise and fall times for independent sources.

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