

# HSPICE Toolbox for MATLAB

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The Hspice toolbox for Matlab is a collection of Matlab routines that allow you to manipulate and view signals generated by Hspice simulations. The primary routine is a mex program called `loadsig` that reads binary output files generated by Hspice transient, DC, and AC sweeps into Matlab. The remaining routines are used to extract particular signals and view them.

We will begin this document by explaining how to include the Hspice toolbox in your Matlab session. A list of each of the current functions will then be presented. Finally, we will provide examples of using these routines to view and postprocess signals from Hspice output files.

## Setup

To use the Hspice toolbox, simply place the included files into a directory of your choice, and then add that directory to your Matlab path. For example, inclusion of the path `'/home/user/matlab/bin'` in Matlab can be done by adding the line

```
addpath('/home/user/matlab/bin')
```

to the file `startup.m` located in your home directory. In addition, you can specify the plot background to be black (similar to the look of Awaves) by adding another line to `startup.m`:

```
colordef none;
```

Once you've made the above changes to `startup.m`, start Matlab as you normally would. Matlab will automatically read `startup.m` from your home directory and execute its commands.

## Platform Compatibility

All files should work across different computer platforms, though the `loadsig` mexfile may need to be recompiled. It is currently compiled for Sun, Redhat Linux, and Windows 2000/Xp machines. To compile the `loadsig` function for a different platform, go to the directory containing `loadsig.c` within Matlab, and then type `mex loadsig.c` within Matlab.

## List of Functions

The following functions are currently included in the Hspice toolbox:

- `x = loadsig('hspice_output_filename');`
  - Returns a Matlab structure into variable `x` that includes all of the signals that are present in the Hspice binary output file, `hspice_output_filename`.
- `lssig(x)`
  - Lists all of the Hspice signal names present in the structure `x`.
- `y = evalsig(x, 'nodename');`
  - Pulls out the signal `nodename` from the structure `x` and places into variable `y`. The string `nodename` can be an expression involving several Hspice signals. If you only performed one sweep in the simulation (as is common), then `y` will contain one column. If you performed several sweeps, `y` will contain several columns that correspond to the data for each sweep. If you have set the global Matlab variable `sweep` to a nonzero number, however, then `y` will contain only one column corresponding to the value of `sweep`. If `sweep` equals zero, all the sweep columns are included in `y`.
- `plotsig(x, 'plot_expression', 'optional_plotspec')`
  - Plots signals from the structure `x` according to the expression given in `plot_expression`. The string `optional_plotspec` is used to create logscale plots; it can be specified as `logx`, `logy`, or `logxy`. The string `plot_expression` specifies the nodenames,

and corresponding mathematical operations, that you would like to view. In this expression, commas delimit curves to be overlayed and semicolons delimit separate subplots on the same figure. All numeric node names should be prepended by '@' to distinguish them from constants. Some examples of using `plotsig` are:

- \* `plotsig(x, 'v1,v2;v3')`: overlays v1 and v2 on the same subplot, and plots v3 on a separate subplot.
- \* `plotsig(x, '(v1+v2)^2; log(abs(v3))')`: plots the listed expressions on separate subplots.
- \* `plotsig(x, 'db(v1); ph(v1)', 'logx')`: plots the magnitude (in dB) and phase (in degrees) of v1 on a semilogx axis.
- \* `plotsig(x, 'v1+@2+3')`: plots the addition of node v1, node 2, and the constant 3.
- \* `plotsig(x, 'integ(TIME,v1); avg(TIME,v2)')`: plots the integral of v1 and average of v2 on separate subplots.

- `tzoom`

- Brings up buttons on the plot to allow nice zooming functions. Type `help tzoom` at the Matlab prompt for more info.

- `figname`

- Allows easy labeling of figure windows. Type `help figname` at the Matlab prompt for more info.

- `xlima`

- Sets the x-limits of all subplots in a figure. Three options are possible:
  - \* `xlima`: sets all subplots to the same x-axis as the last subplot that was zoomed into,
  - \* `xlima([xs xe])`: sets all subplots to the x-axis limits specified,
  - \* `xlima('auto')`: resets all subplots back to autoscaling.

- `eyesig(x,period,start_off,'nodename')`

- Creates an eye diagram for `nodename` contained in `x` with the specified `period`. All data samples prior to `start_off` are ignored when creating the diagram (useful for removing the influence of transient effects from the eye diagram). The string `nodename` can be an expression involving several variables for the CppSim version

(`eyesig`), but assumes a constant time step (which is invalid for Hspice simulations). NOTE: use instead `eyesig_old` for Hspice simulations — this version can only handle one variable and is more primitive than its CppSim counterpart, but does take into account the non-constant time step of Hspice simulations.

## Examples

### Viewing Signals

Use the Matlab command `cd` to go to a directory containing a binary transient, DC, or AC sweep file generated from Hspice. We will assume a filename of `test.tr0`, and now list a series of Matlab commands that will be used to display nodes `q` and `qb` in that file.

- `x = loadsig('test.tr0');` %% loads Hspice signals into `x`
- `lssig(x)` %% verify that nodes `q` and `qb` are present
- `plotsig(x,'q; qb; q-qb')` %% plot expressions of interest

### Doing Postprocessing in Matlab

Use the Matlab command `cd` to go to a directory containing a binary transient, DC, or AC sweep file generated from Hspice. We will assume a filename of `test.tr0`, and now list a series of Matlab commands that will be used to postprocess nodes `q` and `qb` in that file.

- `x = loadsig('test.tr0');` %% loads Hspice signals into `x`
- `lssig(x)` %% verify that nodes `q` and `qb` are present
- `t = evalsig(x,'TIME');` %% loads time samples into Matlab variable `t`
- `q = evalsig(x,'q');` %% loads signal `q` into Matlab variable `q`
- `qb = evalsig(x,'qb');` %% loads signal `qb` into Matlab variable `qb`
- `qdiff = q-qb;` %% perform expressions in Matlab
- `plot(t,q,t,qb,t,qdiff)` %% plot variables using Matlab plot command