MULTISIM DEMO 6.1: PIECEWISE LINEAR SOURCES

There are two main ways to make arbitrary signals in Multisim. The first is using the ABM sources. This has been gone over in a piecemeal fashion throughout the textbook as well as throughout this tutorial. The second primary way is by using a Piecewise Linear (PWL) source.

There are two types of PWL sources: PIECEWISE_LINEAR_VOLTAGE and PIECEWISE_LINEAR_CURRENT. A PWL voltage source allows the user to simply enter pairs of time and voltage values and the system will fill in the rest by connecting the dots in a linear fashion. For example, the pairs (time, voltage) of (0,4), (1,0), (2,0), (3,-3) would generate the signal shown in Figure 6.1.1 below.

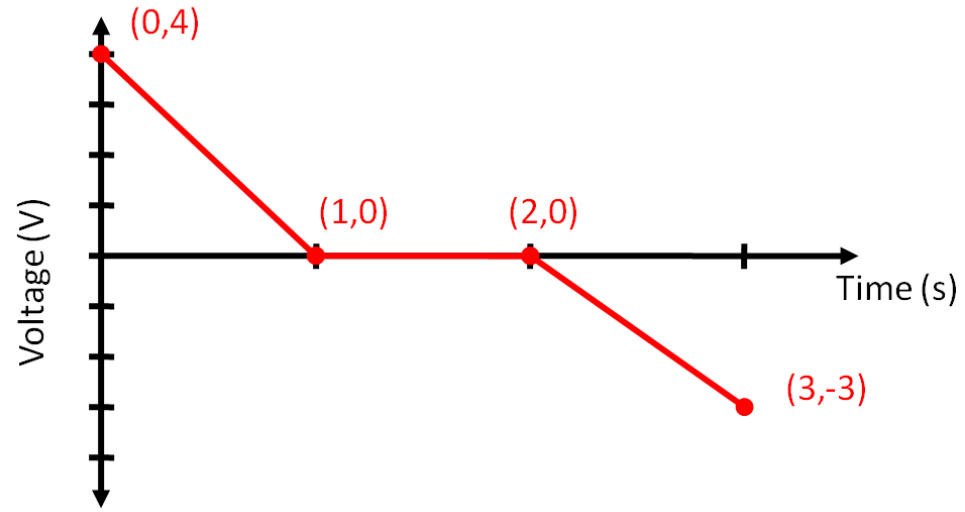

Figure 6.1.1 Plot of voltage vs. time.

To access a PWL voltage source open the Select a Component window and:

1. Set Group to Sources.
2. Set Family to SIGNAL_VOLTAGE_SOURCE.
3. Set Component to PIECEWISE_LINEAR VOLTAGE.

(See Fig. 6.1.2 on the next page.)

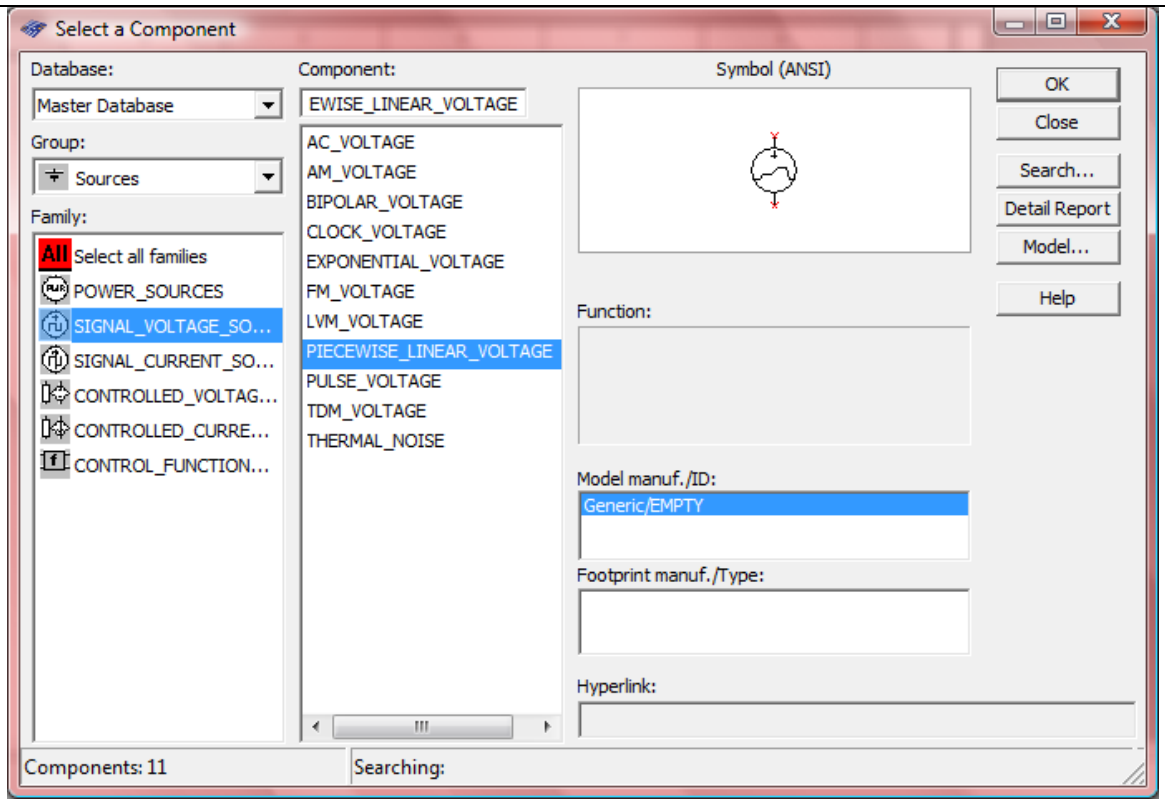

Figure 6.1.2 Where to find the PIECEWISE_LINEAR_VOLTAGE source.

Place the PWL source in the circuit shown below in Fig. 6.1.3.

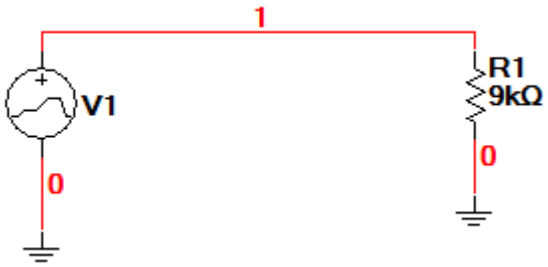

Figure 6.1.3 Build this simple circuit so that we can experiment with the PWL source.

Double click on the Source to bring up the PWL Voltage window.

1. Select the Value tab.
2. Select the "Enter data points in table" button half-way down the window.
3. Enter the time-voltage pairs: (0,4), (1,0), (2,0), (3,-3).
4. Click OK.

The values when entered properly should appear as they do in Fig. 6.1.4 on the next page.

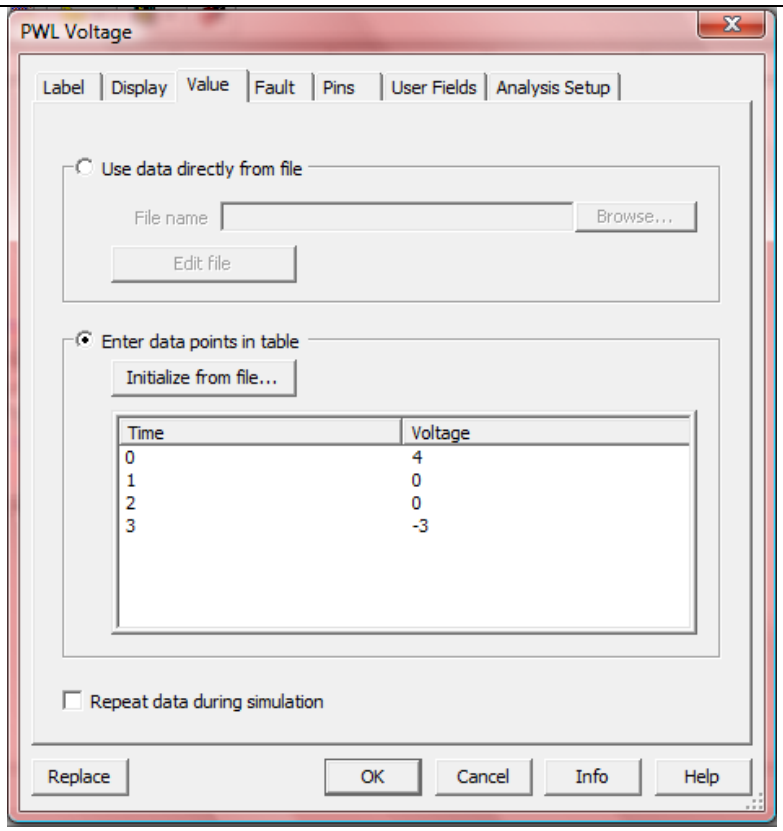

Figure 6.1.4 Data points needed to obtain signal shown in Fig. 6.1.1.

Simulate the output using Transient Analysis from 0 to 3 seconds. Since it is a pretty long simulation, and resolution is not a big deal, you can let the time steps be generated automatically. The output is shown in Fig. 6.1.5 below (with color altered to match the original plot in Fig. 6.1.1).

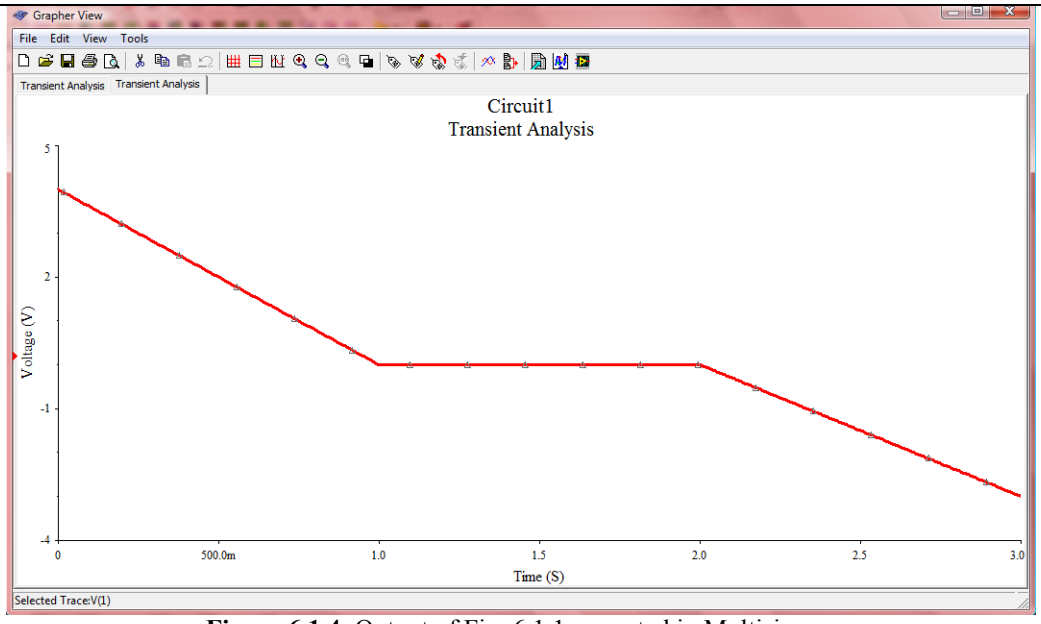

Figure 6.1.4 Output of Fig. 6.1.1 recreated in Multisim.

This matches pretty nicely with plot shown in Fig. 6.1.1.

What if we wanted to make a pulse that rises instantaneously at a certain point? This can be done by assigning two separate voltages to the same time value. For example: Enter the following values into the PWL data points table (Erase the other ones first): (0,0), (1,0), (1,1), (1.5,5), (2,0). Simulate and plot the output using Transient Analysis from 0 to 2 s, with a maximum time step of 0.01 s.

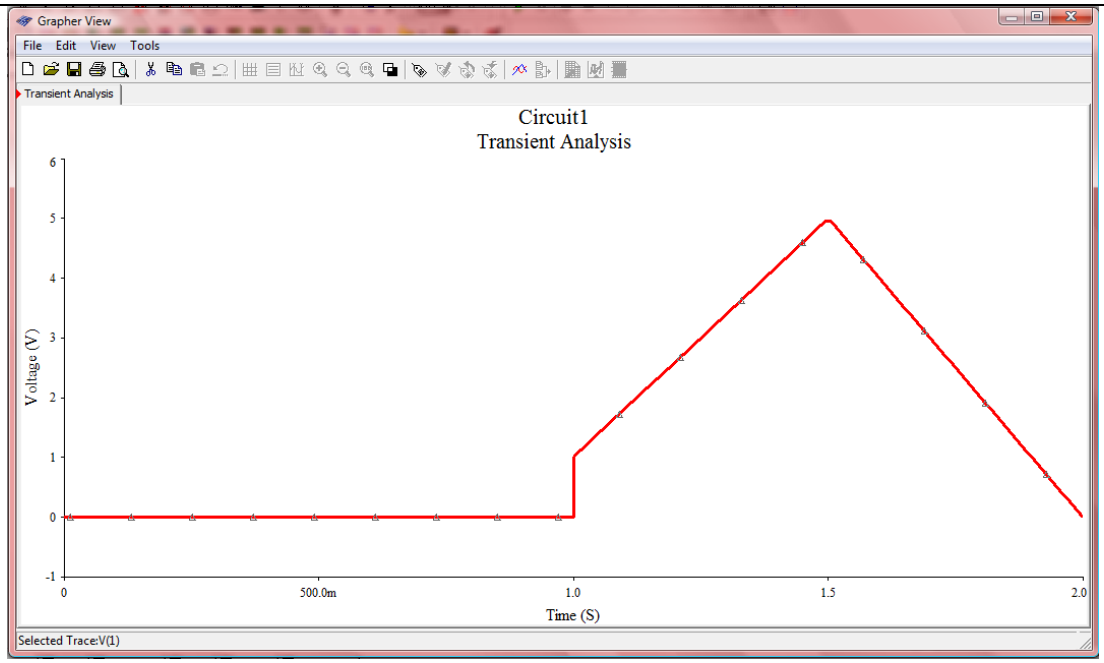

Figure 6.1.5 Signal with an instantaneous step.

As you can see the step appears instantaneous. You have to be careful, however. If you don't make your maximum time step small enough, your plot may end up looking like that in Fig. 6.1.6 below. The step both appears in the graph and will be simulated as slightly slanted (implying a rise time), which depending on your circuit may have a major effect.

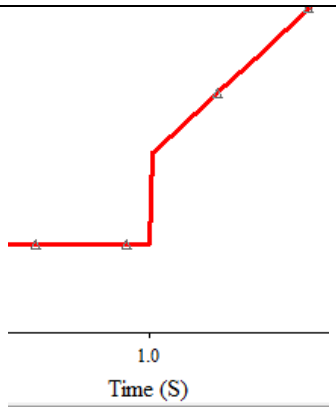

Figure 6.1.6 Instantaneous voltage change with not enough steps.