Subject: Spice crossover models
Posted by Wayne Parham on Wed, 12 Sep 2001 09:41:39 GMT
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I've uploaded a set of Spice models for Pi Speaker crossover networks. It is an interesting study, and allows a person to modify their components to see how they affect the circuit. One can graph the effects of changing compensation Q by manipulating the values of R1, R2 and C1, in both the frequency and time domains.To use the models, just download and PkUnzip the file. Run the "aimsp32.exe" setup file to install Spice on your PC. Then simply load the models for the Pi crossovers and run their response curves. It will show you either the frequency response or the phase response by choosing "Magnitude" or "Phase" from the "AC Analysis" section.Some of the other sections can be run as well, but most have no meaning. For example, to do DC analysis of an (almost purely) reactive circuit wouldn't tell you anything important. It would simply appear as though the woofer was connected and the tweeter wasn't, because the woofer has a series coil connecting it but the tweeter has series capacitors - which are an open circuit to DC. So the important issues to consider are found only in AC analysis of the circuit.The interesting nodes are Node 6 and Node 1. The woofer is Node 6 and the tweeter is 1, so choose them to make your plots. I suggest "playing around" with the format for the X and Y axis so you can view the information in different ways. I personally like to plot amplitude (magnitude) in decibels and to set maximum to "0" and minimum to "-50". This is the "Y-axis" and I like to set it for every 10 decibels. Turn the grid on and put 4 "minor tics" between every major line - so that there's a line for every 2 decibels. And for the frequency "X-axis" - it's appropriate to set minimum to 0, maximum to 20,000 and increment of 5000. That way you get a plot from DC to 20Khz, with a grid line every 5Khz. Again, I'd suggest 4 clicks and to turn the grid lines on.That will show you the response curve of Pi Speaker crossovers with various compensation network values.You can also use the simplified driver impedances I've included, or substitute models that include mechanical reactive components. Examples of the differences in these kinds of models are shown below. So you can substitute these kinds of models for your particular drivers, and plot exact frequency and phase relations of the electronic signal components if you feel so inclined.===! Simplified linear motor! component   node(+) node(-) value R4   1   2   6 L4   2   0   0.1mH===! Woofer virtual circuit! component   node(+) node(-) value! voice coil reactance R3   6   7   6.0 L3   7   9   0.5mH! mechanical reactance (40Hz, Q=5.0) C5   9   0   400uF L5   9   0   40mH R5   9   0   50===! Tweeter virtual circuit! component   node(+) node(-) value! voice coil reactance R4   1   8   6.0 L4   8   11   0.1mH! mechanical reactance (on horn flare) C6   11   12   30uF L6   11   12   3mH R6   11   12   7 C7   12   13   15uF L7   12   13   1.5mH R7   12   13   5 C8   13   0   7.5uF L8   13   0   0.75mH R8   13   0   3