Subject: Re: Need help with crossover design
Posted by Wayne Parham on Wed, 13 Apr 2011 19:04:30 GMT
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You've asked a lot of questions, and there's a lot to cover.

Here are some answers, at least hitting the high points:

First, there are a lot of interactions in a loudspeaker that prohibit casual choices of drivers, horns and crossover topologies. If you don't want to enter into a design/test development cycle that may take some time, you might be better off with a stock design, without any changes. Find a manufacturer and/or designer that you trust, and stick with the plan.

Then again, a loudspeaker is a simple machine, and you can "play around" without doing too much damage. You may not get the best performance, but it will be a learning experience. If you want the best performance, you'll need to do some research, make some educated choices and then optimize the proposed design with models and measurements.

Horns are usually chosen for the directivity and/or loading characteristics. Basshorns are usually chosen by their acoustic loading. Midrange and tweeter horns are usually chosen for their directivity. There are some other concerns, but the main things are acoustic loading and directivity.

HF compression drivers are generally chosen for their passband and their diaphragm breakup characteristics. Voltage sensitivity is a small consideration, and of course, the average impedance. Those two things are inter-woven. Basically, you can expect all compression drivers to be pretty close in voltage sensitivity, and the couple decibels difference is easy to compensate in the crossover. But the size of the diaphragm sets its upper limit, and the composition of the diaphragm, its material and shape sets its breakup modes, how it acts at the top end, above its mass rolloff point. Phase plugs are also a consideration, but really, most of the modern units are similar.

The crossover is the brains of any loudspeaker. If the drivers are its heart, the crossover is its brains. It is not a trivial matter to design a crossover for a speaker, nor is it something you can discuss intelligently without detailed knowledge of the loudspeaker cabinet, the physical relationship between drivers and the electro-mechanical properties of the drivers, themselves.

Some people take the strategy that using active crossovers, they can work through any acoustic kinks they may encounter. I suppose in a prosound environment, where some anomalies are acceptable, this is probably a reasonable approach. You can get the basic tonal balance right and leave it at that. But to get the best summing, to make the forward lobe clean and put the nulls and outer lobes well outside the listening area, you need to be able to optimize the crossover more than just setting up crossover frequencies and maybe turning on a CD compensation switch. There is potential in DSP, certainly, but it is rarely ever realized.
Crossover optimization for DI-matched two-way speakers