Subject: Re: Active 3 PI
Posted by Wayne Parham on Mon, 18 Apr 2011 13:17:04 GMT
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It's not that active crossovers aren't possible for this speaker. It's that you would need to do some work to optimize it. If you don't, then the passive crossover would be better.

I get asked this question a lot, at least a couple times a day, here on the forum or by email. People want to know if active crossovers are better, if they're available and what I think about them. My answer always is, if you have the time to go through a complete design/test/measurement cycle, then you might be able to gain the benefits of biamping. But it's a non-trivial effort, and you can't just assume you can chose the same crossover frequencies, slap it in an active crossover or DSP and go.

Those tools are great, but without some detailed analysis and configuration, the results will not be as good as what the passive unit provides. There's the phase relationship generated by the crossover's influence and by the reactive nature of the drivers, themselves. Then there's the physical relationships between them which create fixed delays, different depending on where each source and the listener is in 3D space. So you really need to do some homework to set everything right.

When I first started building speakers like these, I used to depend pretty heavily on mathematical models. They were all hand-calculated, so it was pretty arduous. I essentially calculated the phase angle of the crossover, and then figured in difference in delay from baffle spacing. My goal always was to find the crossover frequencies and slopes that were within +/- 120°. What I was doing, was essentially setting the forward lobe out front by hand calculation. Primitive, but it actually worked pretty well.

My first crossovers were all handmade, but I realized after several years that some of the generic crossovers would work with a little adjustment. Of course, I had to add a block of components to the core splitter filters in order to get the top-octave compensation needed for CD tweeters. Sometimes I would have to remove or modify one of the core filter components too. But that allowed an easy path for DIY-ers.

Later, when I started making measurements to further optimize the speakers, I often found that the forward lobe could be centered better with a few adjustments. Honestly, it was amazing how close the hand-calculated versions were but naturally I could do better with some visibility. I ended up only really needing to change one capacitor value in the high-pass filter form 8.2uF to 6.8uF. The midwoofer filters sometimes could be improved with a little movement in the Zobel and/or the low-pass core capacitor. So I decided to have boards etched, allowing me to put it all on one board. But all in all, it's very much the same crossover I've used for decades.

Still, what I have now is a pretty highly evolved crossover. It has matured over several years, decades, actually. Now days, I can safely use a sort of cookie-cutter approach. When I want to test a new woofer, for example, I can expect it will work with one of my existing crossovers, at least it's going to be in the ballpark. I may have to adjust a few values, but I don't have to start from scratch.

Crossover optimization for DI-matched two-way speakersI know, for example, that I'll see vertical nulls approximately 40-50° apart in all my loudspeaker models. You can see an example of this in the thread linked above. The centerline may shift up or down a little bit, but I don't have to use the Altec reverse-connection method to find it. It's pretty much straight forward. I know that if I put any of my matched-directivity two-way speakers on stands, a floor bounce notch will result. The cornerhorns won't, both because they're snugged tightly back into a trihedral corner and also because the midhorn and woofer are blended, smoothing it out. So these are some of the kinds of things I can count on, happens every time.

But when you start from scratch, you have more work to do. You should probably start with the basics, and work your way through all the issues that present themselves in a constant directivity loudspeaker. Find and set the position of the forward lobe, perhaps with the Altec reverse connection method. Then find the vertical nulls, and make sure they're outside the pattern. Consider the effects of nearby boundary reflections. These are things that active crossovers really can't do for you.