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Subject: Re: Symmetrical and asymmetrical slopes in crossovers

Posted by [Wayne Parham](#) on Wed, 30 Sep 2009 19:03:49 GMT

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Yeah, I understand. I used to depend on calculations and models very heavily because good measuring gear wasn't available a few decades ago unless you had pretty deep pockets. Even then, I don't suppose it is as good as what we have now.

Before I had good measurement gear, I tried to design speakers with wide tolerance in mind, for example, using overdamped cabinet alignments that wouldn't shift towards being peaky even at high power. I electrically damped crossover networks to ensure they wouldn't have peaks too. I calculated phase and baffle offset, trying to put null angles far enough above and below the forward axis (baffle normal, straight in front) that the listener couldn't be sitting in one, even if my calculations were off because of electro-mechanico-acoustic properties I couldn't see in my simplifying assumptions.

In fact, my first few drafts of my speaker crossover document showed the math I used to do. I removed those pages on phase/summation calculations in the final draft because ultimately, acoustic measurements are easier and more accurate. However, there are a lot of forum posts here that discuss the process of manual calculations of phase and summing, like the one about baffle spacing and phase angles. There are also some Spice models illustrated in the Crossover Electronics 101 seminar I do every year or so at LSAF. These show some of the things I do in crossover design, what to watch out for and how to deal with things like driver reactance.

Now days, with measurement gear so affordable (some is free, like Speaker Workshop), I have the ability to see into the acoustic realm and I take advantage of it. It is work to make a few dozen measurements to get polar plots, but it's a heck of a lot easier to move the microphone around and find the nulls than to manually calculate them, for example. So in a way, having the measurement gear makes design work a lot easier, certainly if you're trying to be fairly rigorous.

I think you still have to do the initial homework, to get the design in the ballpark, so to speak, prior to measurements. You have to make appropriate driver selections, for example. Crossover frequencies have to be pretty close, certainly for speakers designed for uniform directivity (even through crossover points). The measurements help you refine the design, to get things just right. The final design phase becomes a test/adjust cycle, where you fine tune crossover components to set the phase, frequencies and slopes for perfect summing throughout the pattern.