Subject: Crossover Document
Posted by Adrian Mack on Mon, 12 Jan 2004 00:03:48 GMT
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Hey WayneIn the Speaker Crossover document, how did you determine the lower and upper bounds of the crossover? Also, what does it mean when the crossover is symmetrical?Thanks!Adrian

Subject: Re: Crossover Document
Posted by Wayne Parham on Mon, 12 Jan 2004 03:31:53 GMT
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A symmetrical crossover is one that has matching low-pass and high-pass slopes. An asymmetrical one has staggered slopes or frequencies or both.I consider the upper and lower bounds of the overlap band to be the frequencies where the stop band driver is attenuated 6dB. It's a fuzzy area though, because the real issue is whether there is enough energy between the two drivers to cause cancellation at the null angles. Deep into the stop band, a driver can't make any sound, so nulls don't form. Only in the overlap band where both adjacent sound sources are online will nulls form. A symmetrical crossover is one that has matching low-pass and high-pass slopes. An asymmetrical one has staggered slopes or frequencies or both.

Subject: Re: Crossover Document
Posted by Adrian Mack on Mon, 12 Jan 2004 05:59:20 GMT
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Hey WayneI had a feeling the lower and upper bounds were the points where both drivers are still generating output audibly, but at an attenuated level, sort of before it starts going "offline". Or something like that, I was just wondering if you had a way to calculate these limits or weather you just choose a point, like at -6db attenuation, -12db, etc. Since the crossover is a reactive component, then phase shift from this would be considered. On the 3rd order network, you've just told me that its 135deg at the crossover frequency (which would be the border before it starts becoming destructive). For this example I'll have 1.6KHz as the crossover frequency. If we shift the tweeter forward 1.05", which is 45deg or 1/8wl of 1.6KHz, then add that 45deg to the 135deg of phase shift produced by a 3rd order crossover at the xover point, would make the sound sources 180deg apart and complete cancellation would occur at the crossover frequency, is this correct? Can we consider the acoustic center's as well. Put the listener on axis in front of the speaker, but have the acoustic center of the tweeter 1.05" in front of the woofer's acoustic center. Assume same conditions as above example - 1.6KHz xover point and 3rd order xover on both woofer and tweeter. Even on-axis then you would have a huge cancellation at the crossover frequency if we shift the acoustic center of the tweeter 1.05" forward. ..... But isn't the onaxis

and nullaxis positions shifted if the acoustic centers arn't aligned? Or is it only the nullaxis that is shifted? That cancellation onaxis I described above would still occur though and on axis, even if the axis is shifted? Thanks!Adrian

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Subject: Oh, made an error
Posted by Adrian Mack on Mon, 12 Jan 2004 06:21:21 GMT
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Hmmm, I guess the 3rd order network is 135deg at xover freq, so adjacent 3rd order networks would be 270deg apart at xover point. Kinda ruins my whole post, haha. I'll just rewrite it correctly this time. Take adjacent drivers, both 3rd order networks on each and 1.6KHz xover point. The crossovers are 270deg apart at xover point, the next time complete cancellation occurs is at 540deg or 3/2 wave. If we move the tweeter 6.35" forward, which is 270deg of 1.6KHz, then combine that with the 270deg phase shift of the adjacent 3rd order networks at the xover point, then that would make total phase 540deg at the xover point and complete cancellation occurs. Is this right? I should make the correction too for my last paragraph in my last post. Have the tweeters acoustic center 6.35" forward of the woofers acoustic center would cause a 270deg phase shift, combined with 270deg of shift from adjacent 3rd order networks makes it 540deg at the xover point so cancallation happens. So even onaxis you could get complete cancellation then if you do it just right (or wrong as its a bad thing). But isn't the onaxis and nullaxis positions shifted if the acoustic centers arn't aligned? Or is it only the nullaxis that is shifted? That cancellation onaxis I described above would still occur though and on axis, even if the axis is shifted? Thanks!Adrian

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Subject: Re: Oh, made an error
Posted by Wayne Parham on Mon, 12 Jan 2004 14:08:04 GMT
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You've definitely got the idea.  The calculations are cumbersome, but not too difficult.Nulls are formed as pockets of areas where certain frequencies are attenuated by out of phase cancellation.  The edges of these nulls are fuzzy, as the phase angle nears 180o and cancellation begins to increase towards the center of the null area.  The center is where cancellation is the greatest.  At the center, a very sharp notch is formed.  Surrounding this is a broader area of general amplitude depression.

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Subject: Re: Oh, made an error
Posted by Adrian Mack on Tue, 13 Jan 2004 12:40:55 GMT
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Hey WayneThat makes perfect sense. I would think the formula Linkwitz gives to approximate the angle where crossover nulls occur is pretty vague, as you could quite easily have a path length distance where the sound sources are exactly or are near 180deg apart even when the system axis is not tilted, or only tilted slightly. Especially since it doesn't consider crossover slopes, then that formula is a little too much of an approximation in my opinion! Thanks!Adrian

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Subject: typo
Posted by Adrian Mack on Tue, 13 Jan 2004 14:46:45 GMT
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left out a part in paragraph two"I would think the formula Linkwitz gives to approximate the angle where crossover nulls occur is pretty vague, as you could quite easily have a path length distance where the sound sources are exactly or are near 180deg apart even when the system axis is not tilted, or only tilted slightly, depending on the amount of driver offset". bold writing is the part i left out

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Subject: Re: Oh, made an error
Posted by Wayne Parham on Tue, 13 Jan 2004 15:06:55 GMT
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The illustration with the Linkwitz formula shows the forward axis is straight in front, but does mention hat it can be shifted by driver position front or back. It is also shifted by crossover phase. The two aren't the same kinds of delay, but if the overlap band is narrow enough, the effects will be pretty much the same. Crossover phase shifts delay by a moving amount proportional to frequency, but this movement is small if the overlap band is small. If the crossover uses low-order slopes, then the crosover band will be wide enough that the null angles will shift through the overlap band, effectively creating a wider null area.

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Subject: Re: typo
Posted by Wayne Parham on Tue, 13 Jan 2004 15:16:56 GMT
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Linkwitz does mention this tilt, actually. He mentions it in reference to crossover phase being retarded, but any sort of delay will cause a shift. So baffle offset, while not equivalent to phase, is certainly equivalent to delay. That's how I interpret his illustration, by mentally substituting "delay" for his mention of "retarded phase".

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Subject: Re: Oh, made an error
Posted by Adrian Mack on Wed, 14 Jan 2004 04:10:47 GMT
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Ah, I get it now. :PCheers - Adrian

Subject: Re: typo
Posted by Adrian Mack on Wed, 14 Jan 2004 15:08:59 GMT
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Thanks for your help Wayne.