Subject: Two-way system
Posted by jeff mai on Sat, 10 May 2003 08:25:31 GMT
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I'm thinking of building a two way system using a 12-inch reflex woofer and a 1 inch comp driver crossed over at 1200Hz. The thing I'm most concerned about is what to expect from the LF section. It seems like this forum would have much experience in this area.Is it reasonable for me to expect both extension to 40Hz (in-room) and, say 96db/w/m sensitivity with good quality reproduction up to 1200Hz? What sort of cabinet volume should I expect (ballpark?) What woofers should I be considering? The Beyma 12K200 looks like a possibility. Lastly, where do I turn for a good, basic primer on designing bass reflex enclosures?Thanks in advance,Jeff

Subject: Two cents
Posted by mollecon on Sat, 10 May 2003 21:28:09 GMT
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Quote: "Is it reasonable for me to expect both extension to 40Hz (in-room) and, say 96db/w/m sensitivity with good quality reproduction up to 1200Hz? What sort of cabinet volume should I expect (ballpark?)"Yes, you can get that sort of response & sensitivity, provided that you're willing to accept a rather large box - I'd say at least 4-5 cb.ft. (~115-140 liters), maybe more. Remember, a loudspeakers bass extension is proportional to box volume, & in inverse proportion to efficiency. And deep bass is 'expensive'. Just to go 1/3 of an octave further down, say from 50 to 40 Hz, you need to either double the box volume OR accept half the efficiency (if you wanna keep the box volume the same).This explains why loudspeakers that can deliver both bass & efficiency inevetably becomes large - & why typical small 'hifi'-type speakers are inefficient...

Subject: Re: Two-way system
Posted by Wayne Parham on Sat, 10 May 2003 23:10:16 GMT
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When choosing midwoofers for a two-way design, I'd suggest looking at four areas - Frequency response, distortion, directivity and electro-mechanical parameters.

The electro-mechanical parameters will set the size of your cabinet and low frequency extension. Naturally, you'll want response to be flat and smooth up through the vocal range and into the overtones, around 2kHz. This one is harder to find because cones begin to flex at higher frequencies, and the best ones to use are well damped, meaning the cone flex doesn't resonate uncontrollably. Suitable woofer candidates will have smooth response at relatively high frequency

instead of a dip followed by a large peak and several dips and valleys after that.

For distortion, look for drivers with a shorting ring. Those are always better. Some of the older alnico drivers can sound nice too, for similar reasons. Drivers with shorting rings or alnico magnets tend to resist flux modulation. Traditional ferrite motors tend to distort more, and while they may sound nice, they usually don't sound as good as motors with shorting rings.

Directivity is largely a function of woofer size, although cone shape and flex modes have an impact too. As already stated, the cone shouldn't excessively breakup, which would adversely affect on-axis sound quality as well as directivity, making peculiar off-axis patterns. The cone size is important too, with larger cones becoming directional at lower frequency. I generally prefer to stick with 12" and 15" woofers for DI-matched two-way speakers, because they can be favorably blended with a 90x40 horn at a useful crossover frequency. The best crossover range, in my opinion, is between approximately 1kHz to 2kHz because it is above the midrange band, not too high for the woofer to reach nor too low for the tweeter, horizontal directivity is nearly matched and vertical nulls are outside the horn's pattern at HF, provided the woofer and tweeter are reasonably spaced.

When designing speaker systems that use a compression driver to cover the top-octave, I always incorporate CD compensation, which is essentially equalization built-in the passive crossover. Since the compression horn rolls off due to diaphragm mass, it really needs augmentation of the top octave. Some horns provide acoustic EQ in the form of directivity that increases as a function of frequency, but constant directivity horns do not do this so electrical EQ is required. It is easy to implement the requisite 6dB/octave filter and there is a discussion of this and other aspects of

good information that was made available at the Midwest Audiofest in the form of a handout at the "Crossover Electronics 101" seminar.

You might also be interested in the paper called "Improvements in Monitor Loudspeaker Systems," published in volume 31, number 6 of the AES Journal by David Smith, Don Keele and John Eargle. This paper illustrates features of two-way horn monitor systems, and the ideas

designs. Most notable are the discussions of frequency division between components, passive compensation networks for compression horn tweeters, directivity and polar response and proper setup for best imaging.

so pleasant. It wasn't just because of the cornerhorn's uniform directivity, which is what I had always thought. There is also a benefit in setting the speakers so their forward axis cross slightly in front of the listening position. This is a situation forced by the cornerhorn arrangement, but it can also be employed in DI-matched two-way speakers by simply angling the speakers inward 45 degrees.

What crossing the forward axis in front of the listener does is to naturally balance the stereo image. The listener no longer has to sit directly between the speakers, equidistant from each one. Movement towards one speaker moves you further off axis from it, but more on-axis with the more distant speaker. This tends to compensate for stereo balance, making a larger area where the two speakers sound approximately equally loud. It is a setup that offers good imaging over a

much wider range of listening positions. It allows the listener to move in their chair without detracting from their listening experience, and also allows them to share that same good quality sound with others sitting nearby. However, one caveat is that it requires speakers that provide constant directivity.

speaker with toe-in that crossed in front of the listener. But it never occurred to me how the geometry of the forward axis crossing improved imaging until I read the AES paper. In the cornerhorn design, I was mostly interested in boundary loading and how the walls would tend to form CD horn extensions, forcing directivity to be constant down to a very low frequency. The forward axis crossing geometry and how it improved imaging was a happy side effect, one that can be used in other CD loudspeakers as well.