Subject: Re: One Pi Speaker
Posted by Wayne Parham on Fri, 22 Feb 2013 17:13:23 GMT
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Don't run high-efficiency midwoofers sealed. If they're just being used as midrange drivers, that's OK but if they are to be midwoofers, they really need the excursion reduction from port tuning. Besides, the phase change is in the modal region where we don't care, and it might even be beneficial. So I see no reason to ever use sealed cabinets for high-efficiency designs like these. If you're going to high-pass them, crossover at the Helmholtz frequency.

Bill Epstein tried a slanted enclosure and said it sounded weird. I don't doubt it, because the crossover is a first-order design, which marketing types would call "transient perfect", and this kind of crossover depends on the drivers' acoustic centers to be vertically aligned. Said another way, the forward axis is normal to the baffle, which means a slanted baffle makes the forward axis shift. It's basically pointed in a direction perpendicular to the baffle. This is not unlike other properly designed speakers, but my point is this crossover type requires the acoustic centers of the drivers to be vertically aligned.

As an aside, I always bristle at the marketing phrases "time aligned" and "transient perfect". My smaller speakers use first-order crossovers and those have been dubbed "transient perfect". But then again, the higher-order crossovers in my waveguide speakers provide a similar acoustic phase, e.g. quadrature or less shift, within 90°. So I suppose I could promote this, as so many loudspeaker manufacturers do. But it always kind of rubbed me the wrong way. I like to speak in terms of the position of the forward lobe. Seems more appropriate, less like "marketing-speak".

I use first-order filters on my smaller speakers with dome tweeters because they have a little more excursion capability. This approach allows more overlap, which is helpful for maintaining the uniform horizontal pattern. Where the midwoofer pattern begins to narrow, it is blended with the tweeter pattern which is very wide. This provides nice uniform coverage, with the baffle setting the pattern at 180°, perfect for surrounds.

It may be useful to bring in a comparison with my larger waveguide speakers, since they are

great main speakers too, but they are more commonly used as surrounds with my larger waveguide speakers as mains.

Voicing is similar between each model, with the midwoofers defining the body of the sound. My larger speakers use compression drivers on waveguides that are very natural and pure sounding, delicate but powerful at the same time. To me they sound a lot like an audiophile dome tweeter but with higher SPL capability. They are also more directional. But the narrower beamwidth of a waveguide, while attractive for mains, is a disadvantage for surrounds. So basically, I suggest

is more suitable for surrounds.

As for the crossover differences, waveguides should not use first-order filters because compression drivers have very limited excursion capability. You really have to limit out-of-band signals, and the waveguide chosen should also provide acoustic loading. Both are important for

proper use of a compression driver. But since the acoustic phase relationships of all my loudspeakers are similar - first-order crossovers in my smaller speakers and higher-order crossovers in my waveguide speakers - summing is good and the forward lobe is pure in each of them. They are all "voiced" similarly, so they match well with one another in a system. The biggest differences between my smaller 180° speakers and my larger 90° waveguide speakers are their directivities and SPL capabilities.

Back to the topic of compression driver excursion - another aside - I've seen DIYers over the years ignore this limitation, and I suppose when running flea power tube amps, it is OK but it is risky on any loudspeaker presented any reasonable amount of power. Some DIYers try to run the waveguides much lower than is appropriate, in order to "match" directivities at low frequencies where all sources are omnidirectional. Another mistake is to use a shallow waveguide that doesn't provide adequate acoustic loading. Some even use both approaches, using a shallow waveguide and low-order crossover, trying to implement a "transient perfect" first-order crossover.

I would argue strongly against these practices because they completely defeat all the strengths of the horn/waveguide approach, and leaves the compression driver vulnerable to over-excursion. It severely limits dynamic range to use a low-order crossover and/or too low a crossover point on a compression driver, or to use it with a shallow waveguide that doesn't provide adequate acoustic loading. Without the proper crossover and acoustic load, distortion rises and risk of damage is high.