Subject: Smoothing Effect on FR of multiple speakers
Posted by Still Marlboro on Tue, 01 Sep 2009 14:47:01 GMT
View Forum Message <> Reply to Message

Bill Fitzmaurice commented some years ago on a smoothing effect of the FR of having multiple speakers in a line array. It was his contention that since each speaker's FR is not exactly the same that statistically we could expect, and that measurement-wise he saw, the speakers to regress their responses closer to an average between all of them.

I do believe this to be true. But I also believe that it won't work unless each speaker is isolated from its "peers". In a line of tweeters, this is not an issue, since tweeters are by their nature insulated from each other. But many line arrays have as tendency to put all the midranges in one box all to reinforce each others deficiency resonances with sound from the back impacting them. And with cabinets that are pretty shallow this gets worse.

So I believe this characteristic only works when each midrange is physically and acoustically isolated from its peers.

Marlboro(returning to Marlboro from Eric J since I cannot get the system to recognize my password on the origianl Marlboro)

Subject: Re: Smoothing Effect on FR of multiple speakers
Posted by Wayne Parham on Tue, 01 Sep 2009 15:41:14 GMT
View Forum Message <> Reply to Message

Have you tried to use "art" as your password for your original login? When we ported to the new forum software, everyone's password was originally set to "art" because we don't store passwords, so couldn't copy them over.

If you try to login with "art" password and it doesn't work, I can easily and would gladly reset it for you. Just send a note to webmaster@audioroundtable.com. It will probably be Thursday before I can get to it though, as I'll be away from computers for the next two days.

I suppose drivers would vary some from unit to unit, but I think the biggest deal is the change in position in 3D space (or as you say, each driver being isolated from its peers). This causes different path lengths to the room boundaries and shifts the phase of reflections.

When I've measured drivers, I usually see pretty much the same response curve from each. The electro-mechanical parameters do vary, but those set the low frequency range and the differences between units is not large enough to make one hugely peaked and the other overdamped in the same cabinet. So the shifts are subtle, really, and completely swamped by room effects. Up high, the cone flex modes are more chaotic looking, but unless the cones are very different (like one has a glob of glue and another doesn't), then the major breakup peaks and dips happen pretty close to the same place. So while you might see some averaging of the "little squiggies", the major peaks and dips (that really count) stay in the same place.

On the other hand, modal averaging in 3D space is a big deal, accounting for a significant smoothing. As an example, a floor bounce (self-interference) notch from a single driver placed a few feet up is usually 10dB or thereabouts. Put a few more drivers in an array and they all average together to smooth the notch, making it completely unnoticeable. One driver may have a notch at 90Hz, another at 120Hz and the third at 150Hz - if each were driven alone - but when the three are run together, each notch that would have appeared from a single driver alone is "filled in" by the other two. So this kind of spatial averaging is extremely significant.

Subject: Re: Smoothing Effect on FR of multiple speakers
Posted by Still Marlboro on Tue, 01 Sep 2009 15:49:13 GMT
View Forum Message <> Reply to Message

I wonder if you measured them individually and then measured them as their sound mixes with the others.

Now I know that sound that returns to you in an echo or a"backwash" through the speaker that is different than the primary projected sound by less than about 30 millisecond is not recognized by the brain. But I still contend that while not recognized as a significantly different tone, it does add to the muddiness of the speaker sound, something that is simply too subtle to show up on a FR curve, but clearly audible in an AB comparison.

As you describe above, real world interactions of sound often are different than simple graphs.

Subject: Re: Smoothing Effect on FR of multiple speakers
Posted by Wayne Parham on Tue, 01 Sep 2009 16:07:34 GMT
View Forum Message <> Reply to Message

I measure drivers individually and then as their sound mixes with others. The reason there is a change in FR is due to acoustic summing, both from the direct sound and the reflected sound. It is a very real and measurable effect, easily seen in the amplitude response. Of course, it can also be seen in the time domain, but we're talking about smoothing the frequency response here.

The whole multisub concept is based on this, however, the phenomenon isn't limited to low frequencies. It's just that at low frequency, the room modes are so far apart as to be noticeable, so the smoothing is really beneficial there. It is dense interference, something that can be useful at times.

Ideally, one would prefer constructive summing, but if that's not possible, then the next best thing is dense interference, which smooths the sound field by making the interactions so complex that the sound field is averaged. What's not so good is interference that causes noticeable peaks and dips at fairly widely spaced intervals, on a scale far enough apart to be easily identified.
