Subject: Multisub explained
Posted by Wayne Parham on Sun, 18 Oct 2009 16:24:42 GMT
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I'd probably generally suggest crossing subs below 100Hz but in smaller rooms, sometimes a little higher crossover is merited for specific setups. This is part of the multisub approach, which distributes low frequency sound sources. By "low frequency sound sources", to be more specific, I am refering to frequencies below the Schroeder frequency, usually somewhere between 100Hz and 200Hz.

Contrary to the traditional view, which is to try and keep sound sources acoustically close (within

frequency. In a very large room, the Schroeder frequency will drop below 100Hz; In the largest rooms, it can even drop below the passband. In such a room, the entire audio range creates a reverberent field instead of having a modal region in the bass. That's why very large rooms can be setup sort of like you would outdoors, at least in the bass. But indoors in any room smaller than a few thousand square feet, the modal range extends up into the audible band, so room modes form. It's better to distribute bass sound sources in this environment, and in most rooms, that applies all the way up into the lower midrange.

That's where it gets a little tricky, because you certainly don't want to allow localization of distant sound sources in the midrange. However, midrange frequencies have shorter wavelength so being "acoustically distant" in the lower midrange really means just being a couple feet away. That's how I usually blend the woofer and midrange to smooth room modes - I overlap two sound sources (either midrange and woofer or sub and midwoofer) up to just north of 100Hz somewhere. I define midrange as starting at 100Hz, by the way. Others may still consider that midbass or something, so I thought I should clarify. When I talk about blending in the lower midrange, I'm talking about frequencies around 80Hz to 160Hz or so. The very bottom end of the lower midrange, transitioning to midbass.

When making a three-way loudspeaker, I use a physically large midrange (really a midwoofer) and I run it low enough to blend with the woofer below 200Hz. Instead of putting it close to the woofer, I separate them a couple feet. This tends to smooth the upper range of the modal region, up close to the Schroeder frequency. The upper crossover and physical relationship with the

Similarly, when I'm running DI-matched two-way speakers as mains, I generally put a sub a few feet from each and run the subs fairly high, sometimes upwards of 100Hz. The idea is the same, to blend the midbass with sounds sources that are distributed. I wouldn't push a sub used outdoors this high, but indoors, I would, and I'd place them this distance apart. When I'm running subs that high, I call them "flanking subs" and I keep them within a few feet of the mains. They might go to 100Hz, 120Hz, even 150Hz sometimes and with a relatively slow rolloff, like second-order.

I sometimes also run another pair of subs further away, and cross them over lower. The idea with the more distant subs is the same, using several sound sources that are acoustically distant to average room modes. These more distant subs will smooth the sound field better at lower

frequencies, but naturally, should also be only used at the deepest frequencies. You don't want to be able to detect that they're even on.

Now that I've told you what I do, I'll tell you why I do it. For people that have studied sound a little bit, it seems counter-intuitive to spread your woofers around all over the room. For one thing, you would think it would mess up the stereo imaging having woofers all over the place. For another

destructive interference and comb filtering will result. So why in the world would you want to do this?

The reason is that indoors, constructive summing is truly impossible. Below the Scroeder frequency, reflections from the walls, ceiling and the floor interact with the direct sound to create

The "Schroeder frequency" is defined by the approximate frequency where the lobes and nulls from self-interference are separated enough to be clearly defined and easy to detect. Above the Schroeder frequency, the sound is said to form a reverberent field. At this point, interference is so dense it sort of averages out. The goal of the multisub approach is to make dense interference below the Schroeder frequency so it acts more like a reverberent field too.

To visualize this, think about what's happening. Sound reflects side to side, up and down, front

sitting in what is called a null. There is a notch at that frequency in that position. Move closer to the room boundary, and the notch disappears at that frequency, but another notch forms at a

You find at low frequency, these pockets of live and dead zones are pretty far apart. It's really obvious when you're in a null or a lobe. They show up as big peaks and valleys in measurements and you can hear the bass suckout in some places, boomy in others. Room damping helps a lot, but if you're in a room with rigid walls (concrete or brick), it's really noticeable because the damping is poor.

The idea of the multisub approach is literally to add more room modes. Where a notch would be found from a single woofer and its self-interference reflection(s), another woofer (or two or three) can fill in the hole. This requires, of course, that they be distributed throughout the room in appropriate positions. And since the Schroeder frequency extends up into the midbass and even lower midrange, this same approach can be used up to about 150Hz - 200Hz. Careful choice of (crossover) overlap and driver position are the keys.