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Subject: Floor bounce effects frm Four Pi?

Posted by [Norris Wilson](#) on Thu, 30 Apr 2009 01:01:17 GMT

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I was wondering how much the floor bounce effects the over all fequency balance of the Four Pi? Primarily when they are placed flat on the floor, and not slightly tilted back?Is there a certain frequency range that will be more prominent over others in this position?Also, what would be the effect in different room boundry loading positions, 1/4, and 1/2 space?Norris

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Subject: Boundary conditions and floor bounce

Posted by [Wayne Parham](#) on Thu, 30 Apr 2009 04:54:40 GMT

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Boundary loading increases SPL because it constrains the radiating angle. Where a sound

reduces the radiating angle. So at low to mid frequencies, the first-arrival sound is louder. However, the speaker is more directional above around 1kHz, so the boundaries have less effect, provided of course that the speaker orientation is right (not pointed at a boundary).As you might guess, the boundary conditions make a sort of EQ because of the directivity they impart. Boundary loading actually counters acoustic EQ, making the directivity more constant. Consider the fact that the collapsing directivity of a direct radiator tends to provide acoustic EQ in the form of rising response. Boundary loading counters this because the pattern is constrained at low frequencies, so collapsing directivity cannot take place until a higher frequency. Directivity has to collapse further than the limit imposed by the boundaries.Take corner placement, for example. The sound field is constrained to a 90° trihedral pattern. So the sound field cannot possibly be wider than this. If the loudspeaker were in free space, it would radiate omnidirectionally and would not narrow to this point until a fairly high frequency. Even at the frequency where the pattern were said to have narrowed to 90° from collapsing directivity, it still would be only 6dB down at the edges. The walls of the room confine the acoustic energy more fully than that.The end result of it all is boundary loading "boosts" the low to midrange frequencies, and gradually less as frequency goes up. It is important to understand that what is happening isn't really "boosting" the lows but confining them. It's purely a function of directional control, much like what a horn or waveguide does. But the effect produced is of apparent boost of bass and midrange

is "voiced" for that position. In practical terms, it works well in just about any position in a typical home living room. If you put it in a corner like a cornerhorn, the midbass would be a little stronger than designed, and if you put it on a stand in the middle of the room it would sound a little thin. But just about any other position is good.Floor bounce is entirely dependent on height. It causes a notch somewhere, usually in the lower midrange, when speakers are placed on stands. That makes a trade-off of competing priorities for two-way speakers. Either you put the midwoofers close to the ground to migitage floor bounce, or you raise them off the ground on stands to put them at ear level, or perhaps nearer to the video screen.One way to get around the competing priorities problem is by adding subs. If you add subs and put them a few feet away from the mains, then blend them with a fairly wide overlap, they will smooth each other, much like the

multisub approach but in the midbass region where floor bounce might otherwise be a problem. It's a really great approach, actually. The mains and flanking subs smooth each other in the upper modal region, and you can put subs further away too if needed to smooth bass at lower frequencies. I would suggest low-passing the subs closest to the mains somewhere around 100Hz and the more distant subs lower, maybe around 50Hz.

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Subject: Re: Boundary conditions and floor bounce  
Posted by [Norris Wilson](#) on Thu, 30 Apr 2009 16:14:53 GMT  
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Thanks Wayne, Great information as always, easy to understand. You said: "Floor bounce is entirely dependent on height. It causes a notch somewhere, usually in the lower midrange, when speakers are placed on stands. That makes a trade-off of competing priorities for two-way speakers." Is there a desired placement of the four pi's from the floor and back wall that would balance the reinforcing bass level and midrange notch when using them with multiple subwoofers? I noticed that you usually use risers with the Four Pi's in your application as a stand alone speaker without subs. But, I have not seen your arrangement of the Four Pi position when you are using them with subs. "If you add subs and put them a few feet away from the mains, then blend them with a fairly wide overlap, they will smooth each other" And: "I would suggest low-passing the subs closest to the mains somewhere around 100Hz and the more distant subs lower, maybe around 50Hz." Regarding the overlap between the main speakers and the subwoofers closest to the mains. At what filter slope would you suggest to use here for the main subwoofers, 12db, or higher? Also does the distance of the main subs from the main speakers have any significant bearing on this blending and overlap? And what filter slope would you suggest for the sub placed further away in the room with the 50Hz crossover point, 12db, or higher, like 24db to 48db? Thanks Norris

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Subject: Re: Boundary conditions and floor bounce  
Posted by [Wayne Parham](#) on Thu, 30 Apr 2009 18:39:27 GMT  
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I use a 12dB/octave slope for the low-pass filter to subs. I do not high-pass the mains for home hifi applications. The key here is blending, so overlap is your friend. For subs placed close to the mains, something like 4-8 feet away, I usually use 80-100Hz low pass, something like that. Subs placed further away need lower crossover to prevent localization problems. You want subs to be invisible, not call attention to themselves but rather give subtle foundation. They may rock the house when an earthquake scene is played on a movie, but it should not sound like you have distinct subs. That's what I mean by "subtle". The rumble they can produce may be anything but subtle, but the blend with the mains should be seamless. It's best if people can't tell subs are being used at all. Floor bounce is essentially a modal problem. I distinguish it from others simply because it is fairly constant between various environments while other modes are more variable

from room to room. But the solution is the same, you want to overlap sound sources in the floor bounce range, which is basically upper midbass to lower midrange. The floor bounce notch frequency is not set solely by the distance from midwoofer to floor, it is also set by the distance to the listener. It is, after all, caused by the path length difference from the direct sound and the reflection from the floor. So as the angles change because of varying listener distance, so does the frequency of the bounce. That's why the most effective thing to do to mitigate floor bounce is to have overlapping sound sources spaced a few feet apart in the upper midbass to lower midrange. This can be from flanking subs or it can be from a midrange and woofer, positioned properly and sharing the same range. Multiple subs can be used to smooth the lower room modes as well.

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Subject: Thanks Wayne, got it! (NT)

Posted by [Norris Wilson](#) on Fri, 01 May 2009 03:21:44 GMT

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