Subject: Small-room acoustics
Posted by bcharlton on Wed, 04 Oct 2017 04:39:50 GMT
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I love a little bass from any sound system and I've always liked the idea that if you place several subwoofers distributed around a small room, then a smooth and precise bass is easily achieved. Nowadays, it is common to see many commercial productions being done in small and/or home studios. Is it because the smaller rooms are easier to handle?

Subject: Re: Small-room acoustics
Posted by Wayne Parham on Wed, 04 Oct 2017 20:59:22 GMT
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Actually, small rooms are harder to work with than larger rooms. The reflections and room modes are more intense in a small room. Speakers that can provide uniform directivity help reduce problems in the reverberent field, above around 200Hz, and as you've said, multiple subwoofers help smooth the bass sound field in the modal region, below about 200Hz.

There are a handful of approaches to the multiple subwoofer idea:

1. Symmetrically-placed distributed multisubs
2. Asymmetrically-placed distributed multisubs
3. Flanking subs

Each of these ideas have merits, and some can be used mix-and-match. The basic idea is to have multiple bass sound sources, and most experts agree that the more subs you use, the better. Also most agree that the more subs you use, the less important their positions become. And finally, most agree that there are diminishing returns above four subs, e.g. improvements aren't as drastic going from say four subs to six as there is going from one sub to two. Four subs is enough for modal smoothing.

Symetrically-placed multisubs were first proposed by Todd Welti. He suggested placing subs in four corners, four wall midpoints or at least two wall midpoints.

Asymmetrically-placed multisubs were first proposed by Earl Geddes. He revised his initial fully-random placement suggestion to a strategy of placing one sub in a corner, one at a wall midpoint and one sub in a random spot not in a corner or wall midpoint.

Both of these approaches necessarily have subs far away from the mains, so the subwoofer low-pass frequency must be low - below 100Hz - to prevent localization. Placement and/or crossover frequency and slope can be optimized with measurements, in order to find the best locations and/or to add equalization. But this step is optional, because most of the benefit is gained simply by having multiple sound sources in the modal region.

Flanking subs are my invention. They can be done with or without distributed (symmetrical or asymmetrical) multisubs, but are best used with one or more distributed multisubs. I personally

prefer two flanking subs and two distributed subs.

Flanking subs are placed beside the mains. With L/R mains on stands, each has a flanking sub beside, behind and below it. The flanking sub is sent a low-passed version of the signal sent to the main speaker it is flanking. The low-pass filter slope is gentle, second-order, and crossover is relatively high, around 90Hz-100Hz. This provides energy in the 100-200Hz region to smooth self-interference notches from nearest boundaries and vertical modes, which are generally in this frequency region.

Distributed multisubs, whether symmetrical or asymmetrical, are placed further away and sent an all-channel summed signal with lower crossover, like what is generally available on the LFE channel. Crossover slope is steeper, generally fourth-order, and the frequency is low, around 50Hz-60Hz. Naturally, with such low crossover, the modal smoothing can only be provided at low frequencies, but that's what the distributed multisubs are intended to do. They smooth the lowest frequency room modes.

Subject: Re: Small-room acoustics
Posted by mamoss on Mon, 16 Oct 2017 18:33:28 GMT
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Quite some explanation Wayne; how I wish I knew half of what you just explained. My producer friend prefers small rooms but now see how much he has to put in.

Subject: Re: Small-room acoustics
Posted by TechFreakofNature on Tue, 17 Jul 2018 12:52:53 GMT
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I've had to downgrade my subwoofer to something less powerful because I live in a small apartment and the sound was just bad in my living room, it was bouncing off the walls. Even though I love me a good bass, it was too much

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Subject: Re: Small-room acoustics
Posted by Wayne Parham on Tue, 17 Jul 2018 20:17:13 GMT
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The problem in small rooms isn't sound pressure level, because that's easy enough to fix simply by turning the volume down.

The problem is room modes; Regions that have no bass at some frequencies adjacent to regions with too much bass at some frequencies.

A number of subwoofers placed around the room will provide more uniform sound than a single subwoofer. Each sub is driven at very low power levels - an amount appropriate for balanced sound.

Three or four subs run this way will create much smoother bass throughout the room than a single sub will, even if the one sub generates as much acoustic power. The single sub will sound boomy in some locations and thin in others.
