Subject: Multiple Subwoofers
Posted by Lancelot on Tue, 16 Feb 2010 00:29:02 GMT
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What do you think of multiple subwoofers? I know this is an over kill when you have 2 or 3 subwoofers in the system.

What I'm thinking is making the subwoofers surround the room so I can feel all the low sounds that my sound system produces.

Subject: Re: Multiple Subwoofers
Posted by Wayne Parham on Tue, 16 Feb 2010 00:46:36 GMT
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Multiple subs are the only way to go in my opinion. It's done more to smooth out room modes than to increase SPL. The idea is to place them around the room in different places so self-interference that is destructive from one sub is filled in by another sub. The different distances between each sub and each room boundary is what does it.

Posts about multisubs

Subject: Re: Multiple Subwoofers
Posted by Duke on Tue, 16 Feb 2010 20:34:00 GMT
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For the record, I'm another advocate of multiple subs. While intuitively it seems like overkill especially in a small room, the reason to go with multiple subs is bass quality, not quantity.

The smaller the room, the farther apart the room-induced peaks and dips in the bass region. And the farther apart they are, the more likely they are to be audible (the ear will average out peaks and dips that are close together). With multiple subs positioned far apart and asymmetrically, in effect you are overlaying multiple dissimilar peak-and-dip patterns so the net result is not only smoother but the peaks and dips are closer to one another because there are more of them, so the audible improvement is fairly significant.

One advantage is that you can turn the subs up louder. Usually the limiting factor on how loud you can crank the subs is the loudest in-room peak. Let's say with a single sub that loudest peak is 8 dB higher than the average, so now in order to keep that peak from overpowering the room you have to turn the bass down. If the peak is livable at +4 dB, your average bass level will be set at -4 dB.

But using distributed multisubs, the worst peak is maybe something like +4 dB. So now you can turn the bass up more before that worst peak becomes the limiting factor.

Equalization of a single sub can smooth the bass at one listening position, but the problem is this: The peak-and-dip pattern will be very different elsewhere in the room, so that 50 Hz peak that you notched out is actually a valley somewhere else... only now it's a canyon. Even for a single listening position, I've had people who've tried both report that unequalized multisubs sounds better than a single equalized ubersub.

Some things to keep in mind if you're going to try distributed multisubs:

1. You can use small subs because you will have several of them.

2. They do not all have to be the same.

3. Any subs that will be positioned well away from the main speakers should have a steep-slope lowpass filter so they don't betray their presence by passing audible lower midrange energy.

4. No more than one in a corner.

5. The ideal is to distribute them in all three dimensions. In practice this means one should be closer to the ceiling than to the floor, which has a fairly low WAF, but if we're talking about your mancave...

6. The subs will sum in semi-random phase in the modal region, and effectively in-phase below the modal region. So in addition to normal room gain, you'll get roughly another 3 dB of low bass boost (assuming all of your subs extend down below the modal region). If you're DIYing, take this (as well as normal room gain) into account.

7. EQ is quite effective with multiple subs because the low frequency sound field will be considerably more uniform throughout the room.

Duke

Subject: Re: Multiple Subwoofers
Posted by Wayne Parham on Tue, 16 Feb 2010 22:05:43 GMT
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I agree in all aspects except the points of asymmetry and number of corner sources. I realize you know my position in this matter but I'll restate just in case other readers don't.

There are two schools of thought on this, one championed by Todd Welti at Harmon and the other by Earl Geddes. While they are basically the same, there is a subtle difference: Geddes proposes an asymmetrical arrangement while Welti suggests a handful of symmetrical arrangements. Both agree, however that once you get past about four subs, it doesn't matter where you put them unless they are all grouped in the same spot. Pretty much, with four or more subs, you can put them just about anywhere.

Why that last point is significant to me is that if you use cornerhorns, you can control the radiation

pattern above the Schroeder frequency, specifically limiting it to 90°. I find this to be an elegant solution, one that combines all the best features that can be used to create constant directivity. No other configuration that I can think of gives CD through the entire audio band, but this one can. It does require, however, that the sound sources be placed in corners since the expansion from the apex is what sets the radiating angle at midbass/midrange frequencies up. For a stereo pair, that's at least two sound sources in corners, and some content is bass.

There are Welti multisub configurations that can be employed with more than one bass sound source in corners. One is to have subs in all four corners. As I said earlier, both Welti and Geddes agree that once you get to four subs or so, it doesn't matter where you put them. So from this, I draw the conclusion that the multisub configuration can be successfully deployed with bass sound sources in more than just one corner.

As to asymmetry, while I agree in general, I must always delve a little deeper than that in discussions like these. You remember Geddes talking about this in 2005 or so when he was refining his approach. At first, he suggested complete random placement, with the only caveat being that at least one sub be placed in a corner. I pressed him that "random" was probably not the right term, since random includes all sources grouped together. Perhaps I wanted to be more precise because of my computer background - that "random" includes ordered as well as unordered groupings - but with Geddes usually being somewhat precise in his terminology, I would have thought he would appreciate the distinction. I proposed that Geddes define an algorithm, and he did exactly that: One sub in a corner, one sub at a wall midpoint, and a third at a random position but not the same as either of the other two subs. His goal was not to be random, but to be decorrelated, and his arrangement is intended to provide that.

I see this as being useful and understand what he is trying to do. It's the point of the multisub configuration, to break up the self-interference patterns so they don't line up and reinforce one another. That's ultimately the goal whether you setup more Welti-like or more Geddes-like. But I would remind everyone interested in this concept that the room and its contents are rarely symmetrical, and that in a sense, it is difficult to achieve a truly symmetrical arrangement.

In many cases, you can setup in what appears to be symmetrical but have its nodes look more asymmetrical. Likewise, in some cases, you can setup asymmetrically but still have nodes line up in the intended listening area. Of course, if you're using four or more subs, it gets to be less and less important how the self-interference patterns from each individual sub lines up, because they all interact. But the fewer the number of subs, the more their individual placements become.

One thing that often helps, is the fact that like I said above, most rooms are not symmetrical. You can often arrange the loudspeakers in such a way that they are symmetrical with respect to the listener but not symmetrical with respect to the walls. Sometimes the mains are symmetrical with the room, but the subs are not. And sometimes the mains and a pair of subs are symmetrical, but one or two extra subs are placed that are not. Each of those are valid configurations, in my opinion.

To me, it is attractive to have symmetrically placed point source speakers above the Schroeder frequency because this enhances stereo balance and gives better imaging. I don't think you can really achieve the proper stereo effect without symmetry, and I think probably most everyone agrees with that. I have found empirically that symmetry is also desirable for stereo speakers

down a little below the Schroeder frequency, but this presents an interesting problem when using multiple sound sources at low frequencies for modal smoothing. The lowest notes from a cello or male singer should emit from speakers placed symmetrical with respect to the listener, for example, because you can easily localize the source(s). So what is the best solution in this case? Symmetry for stereo imaging or asymmetry for decorrelation?

One solution I have used is to place midbass/midrange sound sources acoustically distant but symmetrical with respect to each other. Being acoustically distant in the upper modal region generally means just a few feet apart. This provides some smoothing in the upper modal range while maintaining symmetry that is important for imaging and stereo balance. I have done this using midrange and woofer drivers placed a couple feet apart, overlapping between 100Hz and 300Hz or so. I have also done it with what I call "flanking subs". What I do is to place two subs a few feet from the mains and overlap them up to the upper midbass. The trick is to keep them close enough to the mains they sound like they are the same source, but far enough away to provide smoothing in the upper midbass. The low-pass frequency is important too. It's actually pretty easy to dial them in though - if the mains are off you can hear the very bottom end of the midrange but with the mains on, you can't even tell the subs are playing. That's the goal. Other subs can also be used, placed further away and low-passed lower too, of course.

Subject: Re: Multiple Subwoofers
Posted by AudioAJ on Fri, 19 Feb 2010 16:43:30 GMT
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This is amazing information because I always thought one subwoofer was enough. Question I have is does it matter what type of flooring the subwoofer is sitting on? Hardwood versus carpeting, carpeting and pad over concrete. What do you think?

Subject: Re: Multiple Subwoofers
Posted by Wayne Parham on Fri, 19 Feb 2010 17:24:13 GMT
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Crawlspaces are a problem because the chamber underneath the floor forms a resonator that can cause peaky response. It will suckout some sub frequencies and leave others very loud. Other than that, if you have a concrete foundation, I'd say the flooring is not real significant at bass frequencies. It can be too reflective for midrange and treble though, so I usually find carpeted rooms sound best. If you have hardwoods, it can sound congested in the midrange and/or edgy in the treble, but sometimes just a thick throw rug between the speakers and listening position can help.

Back to bass, I think it's best to have a concrete floor where possible, to avoid crawlspace resonances. Those are tough to deal with. Then there are the walls and ceiling. While it may seem counterintuitive, it is best the walls are lossy, which is why framed drywall construction

helps. They can absorb some energy and damp room modes. If the walls are solid, like concrete, brick, plaster or stucco - it is probably best to install a panel absorber, basically just a false wall that can absorb some energy. This smoothes room modes.

Multiple subs aren't necessarily used to increase SPL. For modal smoothing, what you're trying to do is to put sound sources in different places throughout the room. One sub may be enough for the desired SPL level, but it impossible to avoid amplitude fluxuations because the modes are too widely spaced. By using several subs in different locations, you introduce dense interference, which in turn fills in the gaps from self-interference. That's the biggest reason to use more than one sub in the home, in my opinion. It's for smoothness, not for SPL.

Subject: Re: Multiple Subwoofers
Posted by Lancelot on Sat, 20 Feb 2010 04:14:08 GMT
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I have seen a home theater setup where all the speakers are embedded on the walls. The wall is made up of wood on this home theater room. Do you think embedding multiple subs on the wall would be ok? I have feeling that it might damage the walls because of the vibration of the subs.

Subject: Re: Multiple Subwoofers
Posted by Wayne Parham on Sat, 20 Feb 2010 07:13:27 GMT
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Here are some good links on the subject:
Predicting room boundary reinforcement
Studio acoustics
Sub placement

Subject: Re: Multiple Subwoofers
Posted by badman on Thu, 03 Jun 2010 19:42:42 GMT
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I agree with what Wayne has said. Multiple subs are a wonderful thing. I'm not sure I agree 100% with the geddes corner-placement scheme, as maximizing modal interaction for the single sub may leave some leftover ripple, but certainly it's a huge improvement over "Normal" setups.

Distributing in the vertical mode is an aesthetic challenge... I'm toying with about a 30" tall slot sub loaded into the corner, which gets me at least SOME distribution, perhaps stacking another unit on top of this would allow me to deal with that dimension better still.
