Subject: questions on array wiring and such....
Posted by HOMEMADE on Mon, 16 Aug 2004 17:14:41 GMT
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hi , new to this very interesting forum and line array's in general. my first experiment will require 60 3/8" dome tweeters per side(1.5"dia.;from parts express). my first question is on array gain of this size tweeter. will there be any and how high will it be maintained if they are mounted with flanges touching? they are rated @87db , and i am hoping for much more than that(??). my other question is in wiring so many drivers. can i wire all these tweeters in parallel and simply add a series resistor of my amps choice? seems that all tweeters have some form of padding resistors in series with them. if practicle , how would this work on mid-woofer arrays(150hz+). any insight is greatly appreciated. paul

Subject: Answers on Array Wiring
Posted by Jim Griffin on Tue, 17 Aug 2004 00:18:09 GMT
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Paul,I'll try to answer your comments/questions below. If you haven't downloaded and read my white paper you really need to do so. 1. 60 tweeters. A lot of holes to drill. I like the 6 to 7 inch long planar or ribbon drivers for a tweeter line as you get better performance than small dome tweeters.2. "Array gain of this size tweeter. will there be any and how high will it be maintained if they are mounted with flanges touching? they are rated @87db , and i am hoping for much more than that(??).Array gain should occur when the tweeters are spaced within one wavelength center to center. With flanges touching that would be about 10 kHz. But you may not notice too much rolloff in the 10-20 kHz area due to less ear sensitivity in this range. Expect 10 log n gain where n is the number of arrayed drivers. That would be 17.78 dB for 60 per side if you maintain the same array impedance as for the individual driver. This is an overall sensitivity of 87 + 17.78 = 104.78 dB. In practice I observe less than theoretical performance but this is a place to start. 3. "My other question is in wiring so many drivers. Can I wire all these tweeters in parallel and simply add a series resistor of my amps choice?"Paralleling all of the drivers and adding a resistor isn't a good thing. What you need to do is to have strings of series drivers which are placed parallel in groups so that you can achieve the overall impedance that you wish to have. Let us say that you have 60 drivers (8 ohms nominal impedance) and you connect 10 of these drivers in series (a total of 80 ohms for each series string) and repeat this to eventually have 6 groups. Then parallel connect these 6 groups and you will yield an overall array impedance of 13.33 ohms. Various combinations of series and parallel drivers can be used to work to attain the overall impedance you wish. An example would be 64 drivers with 8 in series and then 8 in parallel yields an overall array impedance of 8 ohms which would work great with most amplifiers.4. "Seems that all tweeters have some form of padding resistors in series with them." For a line array you may have to pad down the tweeter line (in the crossover) to match with the woofer line sensitivity for sound balance.5. "If practical, how would this work (adding resistors to achieve a specific impedance) on mid-woofer arrays(150hz+)."Don't add a resistor into the woofer line to pad its output down as you will likely mess up the box tuning of the woofers.Jim

Subject: Re: Answers on Array Wiring
Posted by HOMEMADE on Tue, 17 Aug 2004 01:10:40 GMT
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Hi Jim , and thank-you for your response. I thought my idea of wiring all tweeters in parallel might not be the way to go. I was hoping for a very simple(?) assembly for this project. I have looked over your white paper and I'm trying to absorb all the theory. I want my first attempt to be inexpensive(cheap). I purchased 100 2x3.5" drivers from Styke audio(.60ea.), and plan on starting with a design he has.PE has the tweeters (.32ea), which look to have a 1" pole on the back . 1" holes should not be to bad. I have subs that I can c/o @150hz , so I might take an easy route and use a folded OB. I have been playing with some short lines(36")and I do like what I here , using 5" coaxial car speakers. I do beleive if I find this set-up to have merit , I'll most likely try one of the proven designs available. I am quite happy about the array gain on the tweeters; to bad about the wiring. Paul

Subject: Re: Answers on Array Wiring
Posted by Ralph on Tue, 17 Aug 2004 22:50:41 GMT
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>>Expect 10 log n gain where n is the number of arrayed drivers.

Subject: Re: Answers on Array Wiring
Posted by Jim Griffin on Wed, 18 Aug 2004 01:50:39 GMT
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Ralph,I don't think I mentioned anywhere that the laws of physics (or acoustics at least) are in danger of being validated with this line array stuff. Rather I point out that it is likely that you will not achieve those ideal efficiencies as you take it to their limits.Now first consider an ideal example. Let's say you mounted 100 of those little tweeters that were proposed early in this thread (remember they are individually 87 dB SPL. Even that number of tweeters would only yield a theoretical array gain of improvement of 20 dB or an array sensitivity of 107 dB SPL if ideally coupled. In practice the radiation patterns would not overlap for those 100 drivers so the ideal array sensitivity would be less than perfect. Now measure that array and you'll observe that you have lost some of that near perfect efficiency. (The best solution is to measure the array's performance or have exceptional good modeling software to determine the overall response).Now higher sensitivity drivers can be arrayed but watch out how those high sensitivities are achieved. If their horizontal and vertical radiations are restricted to attain those higher efficiencies, then you'll

observe less than ideal efficiency performance for the array.Bottom line is that the laws of acoustics still apply so don't expect miracles.Jim

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Subject: Re: Answers on Array Wiring
Posted by Ralph on Wed, 18 Aug 2004 02:38:11 GMT
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I did not intend to be condescending so please don't think I did. I just wanted to know what you thought would happen as the array gets closer to 112db/w/m. If the drivers each were 10db louder, what then? My guess is there would come a point where sensitivity no longer increased much with added drivers. I would guess max output might, but sensitivity no. Does that make sense?

Subject: Re: Answers on Array Wiring
Posted by Jim Griffin on Wed, 18 Aug 2004 14:17:55 GMT
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Ralph,Re: Regarding increasing the number of drivers in an array. You are correct that the power handling and upper dynamics range capability would increase. Any sensitivity increase would likely flatten out and not continue to improve.Jim

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Subject: Re: Answers on Array Wiring
Posted by Ralph on Wed, 18 Aug 2004 20:24:15 GMT
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Thanks Jim. It's good to have an expert such as yourself to check my guesses. Are there differences between arrays and horns if pattern and efficiency are the same? Ralph

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Subject: Re: Answers on Array Wiring
Posted by Jim Griffin on Thu, 19 Aug 2004 00:56:03 GMT
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Ralph,I'll be the first to admit that horns are not my forte. By the way horns are often used for line arrays but have issues with wavefront curvature and for driver to driver spacing at higher

frequencies. Clearly though for higher power (pro sound) they are likely the solution.As to achieving the same pattern it is unlikely that a direct radiator line array can match the dispersion characteriestics of a horn. A direct radiator line array essentially has the horizontal dispersion of the individual source--you have no available degree of freedom in the horizontal plane so you get what the driver can do. This can lead to a spacious wide angle soundfield in the horizontal plance that can be magical. When arrayed direct radiators do have reduced vertical dispersion so they improve their gain via their enhanced radiation in that dimension. Horns have both reduced horizontal and vertical radiation so they will have the advantage of higher efficiency than even a direct radiator line source. If you want the highest sensitivity, then horns are the way to go but they pose some issues when placed into an array.I advocate using a line array so that the listening area is located within the critical distance for near field radiation. In this operation you have less sound falloff per distance (3 dB per doubling of distance from the source for the near field line array (NFLA) versus 6 dB per doubling for a point source). This means that the in-room sound will be very uniform from the front to back of the room. Furthermore, the side to side falloff will be wider with a NFLA (the sound you hear can be thought of as a vector addition of the horizontal and vertical radiation patterns). Bottom line more uniform sound within the room with less falloff and wide imaging to boot with less side to side falloff. A 94 dB SPL sensitivity NFLA will radiate the same acoustical power level at 4 meters distance from the source as would a 100 dB SPL point source.Jim

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Subject: Re: Answers on Array Wiring
Posted by Ralph on Thu, 19 Aug 2004 02:03:58 GMT
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Thanks as always.

Subject: My 2 cents
Posted by Bill Fitzmaurice on Thu, 19 Aug 2004 13:03:44 GMT
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Ralph was on the right track when he questioned the possibility of getting to 100% efficiency. That actually would be up in the vicinity of 120dB/watt, and no, you can't get it. The reason why has to do with the same reason why the high end starts to droop as you continually add more drivers.Two things happen when you parallel wire a doubling of the number of drivers. First, you get 3dB of added voltage sensitivity. Add enough drivers and you could in theory get to 120dB/watt IF your amp could operate into a nearly zero impedance load, but since you can't do that you're going to be limited to around 116dB in the real world, which is in the vicinity of 50% efficiency.The second phenomenon that occurs when doubling the number of drivers is that your radiating efficiency doubles, and that gives you another 3dB of sensitivity. This happens regardless of impedance load, so if you have 2 drivers and series wire them you'll lose 3dB wattage sensitivity due to the doubled impedance (and thus halved current draw) but overall

sensitivity remains level as you get 3dB gain from the doubling of radiating area. More or less. The 'less' part of the equation comes from the fact that the doubling of radiating efficiency is not linear; it is frequency limited. Once you get to a certain ratio of radiating area to frequency (I have the formula for that stashed somewhere) you max out on the radiating efficiency side of the equation and you can't get any more. That's another reason why you can't get to 100% efficiency by simply continuing to add drivers. It is also why once you get to a certain number of tweeters, how may being dependant on the size of their respective radiating planes, adding more of them will gain additional sensitivity only up to the 'saturation' frequency, while above that radiation sensitivity remains constant no matter how many drivers are added.There is some question as to planar tweeters being unable to achieve as much radiating area sensitivity gain at high frequencies than, say, domes. The answer is a simple one: planars for the most part start off with a higher radiating area to frequency ratio than domes, so when adding more of them they reach 'sensitivity saturation' sooner. The same applies to horns, where the mouth is the radiating plane.

Subject: Re: My 2 cents
Posted by Ralph on Thu, 19 Aug 2004 19:07:24 GMT
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Thank you.
