Subject: Transient Perfect Crossover's
Posted by Adrian Mack on Sun, 12 Oct 2003 05:07:15 GMT
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Hi everyone,I was looking at this website today and noticed a section on whats called a "transient perfect crossover". The design there is essentially a crossover with a final 2nd order response that sums flat and has no phase shift at all. This seems pretty interesting to me, and I've not seen any other sort of crossover that has no phase shift. No phase shift from the crossover would seem to be the ideal thing, so I'm wondering why it hasn't been used more widely. Its described as "The filters sum to a non-flat, minimum phase response which is then equalized, using a simple passive equalization network which is also a minimum phase network. The final response is flat with no phase shift". The actual document for this can be found at http://www.geocities.com/kreskovs/CrossoverdocN.htmlWhat are peoples opinions on this sort of crossover then? Its a pity its only 2nd order, I prefer higher order crossovers. Adrian

Subject: Re: Transient Perfect Crossover's
Posted by Wayne Parham on Sun, 12 Oct 2003 08:33:43 GMT
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I've voiced my opinions on this matter, and been pretty adamant about it really. It isn't reasonable to expect perfect phase from a loudspeaker; Certainly not with today's technology. One can design to avoid rapidly moving phase shifts and try to widen the radiation pattern where summing is constructive, and those are worthwhile goals. But there are many things that prevent phase from remaining fixed at 0o, so I'm not comfortable with phrases like "time aligned" or "transient perfect".I think the best goal is the one we all strive for, and that's to avoid quick phase shifts which prevent coherent summing. Most only try to maintain this on-axis, but I would go beyond this to include a range of listening positions. That's a worthwhile goal, a requirement for uniform coverage. But to call that transient perfect is just marketing rhetoric.

Subject: Re: Transient Perfect Crossover's
Posted by Adrian Mack on Sun, 12 Oct 2003 08:51:50 GMT
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Hi Wayne,I know what your saying - I haven't actually read through that entire document either, maybe there was a whole lot of rubbish in there that I didn't see. I was just thinking that this 'transient perfect' crossover would get rid of one less phasing source to deal with - the crossover. Obviously there are still phase shifts from the driver/box though, but the final phase shift of the loudspeaker with that crossover must be less still than with the other types that we are already familiar with. I'll probably never try out that crossover though, the stuff we already use sounds good enough to me when done right!Adrian

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Subject: Re: Transient Perfect Crossover's
Posted by Wayne Parham on Sun, 12 Oct 2003 10:20:47 GMT
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You're right about the merits in improving the behavior of the system where phase is concerned. One really wants to make sure that phase offset doesn't become excessive and that interference and lobing are limited throughout the coverage angle. To me, the way to do this is with controlled directivity. That's really more the issue than phase, because it is impossible for phase relationships to be perfect at all locations in 3D space. The best thing we can hope for is good phase relations, i.e. constructive summing, in the target area which is our intended radiation pattern.My approach is to use horns with constant directivity and a pattern that is fairly wide but not very tall. This puts the energy where we want it - throughout the room but not wasted on the ceiling and the floor. It also helps to reduce energies at vertical off-axis angles where path length differences form nulls. The idea is to stack drivers vertically and pick crossover and driver positions that place the nulls outside the vertical coverage angle.

Subject: Re: Transient Perfect Crossover's
Posted by Adrian Mack on Mon, 13 Oct 2003 06:41:40 GMT
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Hey Wayne,Another thing that has been on my mind, say we have a passive crossover, a zobel network, and an attenuation circuit that all need to be hooked up to the same driver. Does it matter what order these circuits go in? As an example, say we took a simple MTM speaker so theres 2 mid's and one tweeter. Since the two midranges play in the same frequency range, then I'd assume it would use a 2-way crossover and the midranges would just be wired togethor and hooked to the midrange output, and the tweeter to the tweeter output of the crossover. The impedance of the two midranges connected togethor is either half or doubled (parallel or series), but what about the reactive impedance of the device? Is the impedance at resonance and also the rising impedance caused by Le remain the same as that for a single driver? Or will it be doubled because there are two midranges hooked togethor on the same circuit? I ask this because I want to know if the same formulas for a Zobel filter (or series notch filter) can be used when two drivers are going to be connected to that same filter, or if there is something I have to do first. The box, weather sealed or vented changes where the impedance peak is, and adds another one if it is vented. In the Pi Crossover Document, it mentions that for the bass reflex speaker or a horn speaker that a seires notch filter/RC damper is not attractive because of the multiple impedance peaks. What came to mind though, is that the formula's required to calculte the values for C, L, and R require the parameters Fs, Qes, Qms, and Re. The formulas for a series notch filter don't include anything about the box, so I'm pretty stuck here. Does this filter formula just assume the person is running the driver with no box so it just damps the peak at resonance as if it was in free air? That would seem a bit strange to me?!Lastly, can Spice model the complete crossover combined with driver response? Do you know of any (free) programs that can model the filters combined with driver response?Thanks!Adrian

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Subject: Re: Transient Perfect Crossover's
Posted by Wayne Parham on Mon, 13 Oct 2003 09:00:26 GMT
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The MTM configuration is an example of what I'm talking about. The goal of the MTM speaker is to use null angles from carefully chosen vertical spacing to create a specific pattern. I like to use directional sound sources which have patterns limited within the null angles. In both cases, summing at vertical angles within the null angle is coherent. As the off-axis angle is increased, the phase angle increases because of the different path lengths. At the null angle, the phase is destructive causing a cancellation notch to form. That's why I like using horns with vertical coverage angles set within the nulls.About the order of crossover components, some circuits configurations can be rearranged, and others can't. Series circuits can always be rearranged and so can parallel, but series-parallel cannot always be rearranged. Look up Kirchoff's laws, and Thevin and Norton circuits in an electronics textbook.

Subject: Re: Transient Perfect Crossover's
Posted by Adrian Mack on Thu, 16 Oct 2003 08:12:54 GMT
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Hey Wayne,When I asked what order do the circuits have to go in, I actually meant like - is there any specific order? EG: Crossover first, then attenuation circuit after that, then zobel after that. Or is there any certain requirements - like, does the zobel need to go before the crossover, or lpad before zobel, etc. I was pondering on weather or not there are changes in any other parameters when two drivers are hooked togethor. Since Re changes (halved or doubled if parallel/series), then BL does too, so Qes does as well, etc. Or is this all "cancelled out" because there are two drivers there? How would I design a series notch filter for the driver in the cabinet where it modifies its impedance at resonance? The typical formula for it damps the free-air resonance impedance peak, so it just uses four T/S parameters. It sounds like its probably quite a lot of work to do this... perhaps it would be better to just not cross near resonance. But even if we dont have the crossover point at resonance - below that, where the crossover attenuates frequencies will also be around the resonance region where impedance is high. Does this still pose a problem to us? Or is it just a matter of having the crossover point itself in a region where impedance is low? In a 2-way design, it doesn't matter about the impedance at resonance as you've said because the xover point is typcially way high, in the kilohertz range and the box tuned low. In a 3-way design with woofer, midrange and tweeter, it could matter for the midrange driver. Then at this point my brain kicked out of "dumb" mode, and one of your comments reminded me that midranges in the 3-way cabinet are typically closed back ones with no box :P So I could just use the normal formula to get rid of the impedance peak at resonance, right? Do people ever use 3-way designs where the midrange ISN'T closed back? (therefore it could be affected by the box?). Thanks!Adrian

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Subject: Re: Transient Perfect Crossover's

Posted by Wayne Parham on Thu, 16 Oct 2003 12:18:32 GMT

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In the case of a passive crossover, the order is important because the source impedance of one component, device or circuit is the load impedance of the one preceding it. For example, in the

the high-pass filter preceding them is slightly underdamped. This generates a shelved response curve, so that the first couple of octaves are flat before HF augmentation begins.

Subject: Crossover stuff

Posted by Adrian Mack on Sat, 18 Oct 2003 23:41:57 GMT

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Hey Wayne,It seems that the stuff that modifies the reactive load needs to go after the crossover, but stuff that doesn't, such as an attenuation circuit can go in any position. So as an example, if we had adjacent 2nd order networks with zobel and attenuation circuit, then the zobel must be after the 2nd order network because it modifies reactive impedance (hence load on crossover), but the attenuation circuit can go before or after the crossover because it just adjusts the output level of the woofer but doesn't change impedance. Obviously in this case though the attenuation would go after the xover so that it only attenuations one driver and not both. So both would be best after that adjacent 2nd order network's, I assume the order of the zobel and attenuation does not matter though?For any other circuit that shapes the reactive impedance of the driver (like the horrid series notch filter) does the same rule apply? (ie: only make the changes to Re and Le in the formulas and nothing else). I think its kind of like when people connect two subwoofers to a mono amplifier. They wire them in series or parallel but they dont need to redesign the box because no T/S parameters change. But DVC drivers, in series it doubles the coil length so BL is doubled, and Re is doubled because of series wiring. Thats with DVC driver. On two seperate drivers does the same thing apply? Or not?Wiring drivers in series/parallel changes Re, and Qes is dependant on Re, so doesn't Qts change too. How come people then can wire two subs to an amp without redesigning the box because of the changed Qes/Qts?The formula I was referring to about that series notch filter is exactly the same as the one on http://www.loudspeakers101.com/ResEqual.htm. It shows how to get rid of the free air resonance-impedance-peak of the driver. I was thinking this is good for those closed back midranges where the box doesn't change the impedance of the woofer, but cant be used where the box does change reactive impedance (like on a subwoofer if anyone was dumb enough to use passive components on this!). Parameter shifting is still a problem though. I typically find that breaking in drivers sounds better than when they arn't broken in. I think its just loosening up the suspension system that does this. Maybe its magic! It took me awhile to break in my 18LW1400 subwoofer. Lastly, arn't the impedance peaks important to how the speaker works. Like.. I know why they are there. But doesn't the reactive impedance reflect/shape the frequency response curve by changing power distribution throughout the passband (by making the amp see different impedance and hence give out different power). So wouldn't damping the resonance impedance peaks (or the rising impedance by Le) change the shape of the frequency response curve? I know you need them to make the passive crossover work properly, but it still bothers me. Thanks!Adrian

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Subject: Re: Crossover stuff
Posted by Wayne Parham on Sun, 19 Oct 2003 11:18:57 GMT
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The transfer function of a passive crossover depends on the load. That's because the load forms a part of the filter. You really need to model a complex circuit to know how it will act. Study up on reactive properties and AC circuit analysis and also Kirchoff's laws, Thevin, Norton and superposition.