Subject: Crossovers - Again !!!!!!!
Posted by RDLewis on Thu, 29 Mar 2012 13:49:17 GMT
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Hello Wayne,

I hope you do not mind, but this is another question on Pi1 and Pi2 crossovers.

As you have described here and other forums, that the series coil acts as more of a voltage divider than a crossover. To quote from - 2Pi Tower update 01/12/03, "It's a stepped attenuator with a nearly flat response curve, having 3 - 6dB attenuation above a frequency where the voice coil inductance becomes significant compared to the series coil. There is no electrical roll off as is expected because the voice coil reactance rises proportionally compared to the series coil reactance. Making them form a voltage divider that is linear with respect to frequency". Which to my lay-mans mind, It flattens the rising frequency response allowing it to form the natural roll off at the top mind.

Though I have seen this being used on other speakers, my first transmission line from "IPL acoustics" used this type. Several years ago I built a pair of TL's using Scanspeak 8554 for a friend, we decided to try out this type and proved to be successful as he is still using them. But it was more by luck as we had no measuring equipment. But your answers on this type of network gives me a much clearer understanding of what is happening in what you have called "Pseudo first order".

You say of course that your preference is for 0.5mH coil, but you did say in "Pi studio two", Feb 07, "some people prefer more coil, may be 0.7mH or even 1mH". The 2Pi frequency response you provide look very impressive. But do you have individual response charts for the Alpha and Vifa, to see how the inductors and caps effect the drivers before they are combined. How about the 0.7 and 1mH.

On the tweeter section you use a damping resistor, which you say is there to reduce the impedance resonance. Interestingly Robert Bastanis uses a variation on this. He uses Eminence sourced drivers to his own specs. His extensive cone doping allow the 12 and 10 inch driver to operate up to around 8khz or so without crossovers. But he does use a 12ohm damping resistor across the bass units. To quote him on his forum "paralleled resistors flatten the impedance which is recommended for tubed amps", and "and the resistors take away some of the energy in the upper in the upper midrange to help the drivers produce a flat amplitude". This is already achieved with your series coil, do you think it would produce an overdamped response using the latter ?

I would grately appreciate you opinion.

Thanks

Roy

Subject: Re: Crossovers - Again !!!!!!!
Posted by Wayne Parham on Thu, 29 Mar 2012 15:44:30 GMT
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Not sure how to respond. Lots of topics in your post, all generally related to crossovers.

I do have a lot of raw measurements, and sort of interim results, like drivers with filters but not combined with other drivers to form a loudspeaker system. These are usually done during development, to see the results of a particular electrical filter, perhaps when the driver is attached to a horn or something. But I've tended to leave those on the measurement system, and not publish them. I used to publish that kind of data, and there's still probably a ton of 'em on my servers somewhere, but I only really publish datasets for finished loudspeakers.

Finished loudspeakers are the sum of many variables. They're simple systems, but they do have interconnected features. They're electro-mechanico-acoustic systems, which means that things like damping can occur in any of the three states, and in most cases, what's done in one realm will affect the others. But there are cases where each state is decoupled from the others. As an example, mechanical resonance shows up in all three states, having mechanical, electrical and acoustic features. You can modify it mechanically by adding mass or stiffness. You can also modify it electrically by shorting the voice coil, providing damping. Where the cone moves as a rigid piston, there is correlation between the mechanical and electrical systems. They move in unison. So the electrical circuit can provide damping for a primary (piston mode) resonance.

Cone breakup is another matter. It usully only shows up in the impedance curve as very minor anomalies, and for the most part cannot be damped electrically. This is because cone breakup is resonance flex of the cone surface, independent of the voice coil movement. The cone in breakup is decoupled from the voice coil, so nothing in the electrical circuit can affect it. You can reduce signals presented to the speaker at frequencies where the cone flexes, but that's about it. You cannot provide an electrical damping for a breakup mode resonance.

Does that help at all? Does it answer your questions?

Subject: Re: Crossovers - Again !!!!!!!
Posted by RDLewis on Tue, 03 Apr 2012 23:44:38 GMT
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A bit late but thank you for your reply.

I guess it was a bit optimistc to think you could easily pull out the driver data, as they were developed 10+ years ago. But if you do come across them I would be grateful to see them.

Where the damping resistors are concerned I am interested in whether they would provide any benificial effects in reducing the resonant impedance peaks at Fs. Such as "fL" in vented systems when using higher Qts drivers. You say above "you can modify it electrically by shorting the voice coil, providing damping", So, depending on the value of the resistor, how much damping would be provided here and could it provide some benifits in, say, using the above in smaller rooms ? Or would it over damp the bass end ?

Thanks for your time,

Roy

Subject: Re: Crossovers - Again !!!!!!!
Posted by Wayne Parham on Wed, 04 Apr 2012 00:04:59 GMT
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Conductance across the voice coil provides electrical damping. The smaller the resistance, the more damping. The most damping is created by a dead short.

Consider that the amplifier shorts the voice coil too. An amplifier with high damping factor is one with low output impedance. It effectively shorts the voice coil. You won't get any more damping than that using a shunt resistance. Not for a driver connected directly to the amplifier, or through a small value coil. The damping provided by the amplifier is like having a direct short across the voice coil, so no resistor is going to improve on that.

Tube amps have less damping, of course, but still usually more than you can provide with shunt resistance. That's why you rarely see resistors across woofers, except for Zobels, which do their thing at higher frequencies. At low frequencies, the amplifier is the primary source of electrical damping.

On a related note, have you ever heard the output transformer of a tube amplifier buzz slightly on loud bass notes? What is happening is the woofer's back-EMF is causing the laminations in the output transformer to vibrate. It's kind of the same thing that can cause a power transformer to buzz. At low volumes, the output circuit can handle it, but at higher levels, the back-EMF becomes excessive. Sometimes it can even cause arcing inside the tube, because the transformer steps-up the back EMF and applies it to the anode. I've also seen woofers create enough back-EMF to generate a chirping sound in piezoelectric tweeters connected to the same circuit.

Those are extreme examples though. If the tube is arcing from back-EMF, then it really shouldn't be driving that load. A shunt resistor won't help much, because the amplifier is still providing most of the damping. It's just straining trying to do it. A resistor with low enough value to increase damping by any significant amount will short-circuit the amplifier, so that's no help.

Where I see the most benefit from shunt resistors is to provide a specific load for a crossover circuit. The crossover somewhat decouples the amplifier from the driver, and so its ability to provide damping is diminished. The amplifier is a dead short, but the crossover filter is a reactive circuit and it is loaded with a complex impedance (the driver). Sometimes the crossover/driver combination really needs a shunt resistance to set everything right.