Subject: Erse caps, attenuation circuits.
Posted by dB on Sat, 07 Feb 2009 04:39:01 GMT
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Hi Wayne,Sorry if you already answer any of this questions. I've been out for a long time and I've been just peeking on your site for a couple of times.1 - Have you ever tried Erse caps, they have such nice specs and are not that expensive (I know you use the coils from the same manufacturer). They compare them with other brand names on their website what is unusual (no fear).2 - On the xover attenuations you use on the compression drivers (R1 & R2), you use (pardon me if you answer this question before) R2 before R1. Is this for the better protection of the drivers, since R1 and driver would be in series? I am using a similar attenuation w/compensation but R2 comes after R1 + Cap. Do you think there is any problem with that, providing the right calculations (and testing on spice)? You are not the only person/engineer proceeding like that...3 - There was one last question for today, and it is related with something you said before (I think in one of your papers). If or when using variable Lpads, do you bring the settings down, of the overall, for how many dBs? I am thinking of having about 3dB of clearance to adjust it up +3dB (0dB for flat response or down for less). Do you think this is appropriate? Let's say you do this for the tweeter, then the woofer must be cut short 3dB from it's response curve, or trashed/waisted half of it's capacity. Am I Right?I also want to say I apreciate very much your postings on the DIY forums, on measurements, you had some time ago, and the patience you show with all members, old and new. I look forward to hearing from you,Best Regards.

Subject: Tweeter circuits for constant directivity horns and waveguides
Posted by Wayne Parham on Sat, 07 Feb 2009 17:36:40 GMT
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I have used Erse capacitors, in fact, they're in stock now and they are used on some of the crossovers I provide as kits or in finished products. I consider them to be about the same quality level as Solen caps. Here's a post I wrote a little while back on what components I use and why:

with a long time ago, using Spice. There are other strategies for providing the requisite CD equalization, but some are more complex than I think is necessary or desirable. My approach does three things: 1) It provides woofer/tweeter level matching padding using a resistor divider, 2) Padding is bypassed by a capacitor to provide 6dB/octave augmentation above mass rolloff, and 3) Specific damping of the splitter filter is set, mildly underdamped so the amplitude near the crossover frequency is slightly elevated. This causes an initial shelf of flat response up to mass-rolloff, where top-octave augmentation begins.
Clarification of attenuation valuesYou could rearrange the R1/R2 values or use an L-Pad as additonal output shunt, in position Rs, after the R1/R2/C1 network. I've seen people do it, some with good results. However, I always recommend against it for best results. The reason is simple: Compression drivers need 6dB/octave HF equalization for a total of 8dB to 12dB boost overall. So any padding you might provide outside the compensation network would reduce the level of top-octave augmentation available. Use Rs to swamp driver impedance peaks, if necessary, but not for additional padding.

Think about it. If your woofer is 12dB less sensitive than your tweeter, then you only have 12dB padding to work with. If you need 12dB augmentation to provide CD equalization, then you need the full amount of padding to be removed at the highest frequencies. There's nothing left to provide for variable attenuation.

The best compression drivers have a fairly smooth mass-rolloff slope. Amplitude response falls at a constant rate of 6dB/octave, starting around 4kHz to 6kHz. That's approximately two octaves from 20kHz, so the conjugate slope requires approximately 8dB to 12dB total augmentation.

There is a synergy here, and I find that the best implementations are those with good quality high-efficiency midwoofers that are about 10dB to 12dB less sensitive than the tweeter on its horn. Everything comes together. The tweeter circuit matches its sensitivity with that of the midwoofer, and equalizes the response curve through the top octave. The crossover frequency chosen is where horizontal patterns approximately match. This and the spacing of woofer to horn sets the vertical nulls outside the tweeter's vertical pattern at HF. When properly done, on-axis response is flat, and directivity is uniform so off-axis response is also flat over a wide horizontal arc.
Two-way systemOn the other hand, I have seen cheap compression drivers with lots of breakup in the top octave. The inexpensive Selenium drivers are a good example. Mass rolloff starts reducing output but diaphragm breakup starts making resonant peaks that increase output in the top octave. This kind of behavior adds "sparkle" and sounds good at first listen, but I find it to be a little harsh, especially when listening long term.

Whether you like them or not, the best implementation of such a device is to not add in full top-octave augmentation, don't provide the full 6dB/octave rise. Reduce it by some amount, so the HF breakup peaks don't rise above the midband level.
L-PadsThere are a number of ways to reduce the amount of top-octave compensation. Padding the output of an R/C filter reduces the augmentation just as much as it reduces the midband level. So you can install a fixed voltage divider or variable L-Pad after the R1/R2/C1 network. Choose values for R1, R2 and C1 that provide 8dB attenuation, for example. Since there is only 8dB attenuation, there can be only 8dB augmentation from the bypass capacitor. Then install an L-Pad or fixed voltage divider after that to provide the rest of the padding. That's one way to provide top-octave augmentation but not allow it rise a full 12dB over two octaves.

There are a number of ways to juggle the values and perhaps rearrange their order to get different results. The method I've suggested provides the right curve for a "pure" 6dB/octave slope that starts around ~5kHz. That makes the augmentation full in by 20kHz. You can increase the value of C1 to bring augmentation in sooner. But if it is made too large, it simply bypasses the padding, removing both level matching and equalization. R1 and R2 values set the amount of padding and the shape of the low end of the curve.

Smaller values of R1 reduce the amount of padding. It also slightly increases damping, rolling off the low end a little more. Larger values of R1 obviously have the opposite effect. Smaller values of R2 increase damping, rolling off the bottom end. Larger values of R2 decrease damping, making the initial shelf rise. Go too far and a peak near the crossover frequency will result.
Optional component Rs can be used to provide additional damping for the driver, used to reduce Zmax of impedance peaks that may be just above the crossover point. Generally the impedance

peaks fall below crossover, because impedance peaks above crossover indicate the horn is too small for the crossover point. But if the impedance peak is just above crossover, this is usually fine, just swamp the impedance peak with Rs, using a value approximately twice the voice coil resistance.

See the link below for more information:
A few useful documentsIn the end, if you're using a high quality compression driver on a well

Crossover provides:

Top octave compensation response curve

Subject: Re: Thanks Wayne!
Posted by dB on Sat, 07 Feb 2009 17:54:36 GMT
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Thanks, I'm going to check it throughfully.

Subject: Re: Tweeter circuits for constant directivity horns and waveguides
Posted by dB on Sat, 07 Feb 2009 18:32:25 GMT
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"On the other hand, I have seen cheap compression drivers with lots of breakup in the top octave. The inexpensive Selenium drivers are a good example. Mass rolloff starts reducing output but diaphragm breakup starts making resonant peaks that increase output in the top octave. This kind of behavior adds "sparkle" and sounds good at fist listen, but I find it to be a little harsh, especially when listening long term."Very true."Whether you like them or not, the best implementation of such a device is to not add in full top-octave augmentation, don't provide the full 6dB/octave rise. Reduce it by some amount, so the top-octave doesn't rise above the midband as a result."Yes, very good point in translating that into words. I have it nailed. I tested a couple (of hundreds) modelations on spice before (for different horns), and it still keeps me going. Nothing a good driver or a professional ribbon can't solve. In another way I learned that also the time involved doesn't come cheap... unless you are having fun... and I don't find a lot of girlfriends (or men so to speak) around interested into building loudspeakers, that's why we have to keep the fests and conferences up!
