Subject: Subwoofer Group Delay and such. Long post, but I hope its interesting, maybe :P
Posted by Adrian Mack on Fri, 12 Sep 2003 07:13:32 GMT
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Hey Wayne,I'd like to discuss a few things about subwoofer phase/group delay. The post Acoustic Suspension vs. Bass Reflex discusses the resonant-overring phenomomen. And I agree with it totally. But I want to discuss the phase shifts throughout the subwoofers passband (normally about 20-100Hz). A PiAligned cabinet takes advantage of the bass reflex box's port to reduce overring. Am I right in saying that the smaller the box, the air is stiffer so that impedes resonant overring more? And also tuning the system so that its not used near resonance means that resonance overring is not really that possible, or at least greatly attenuated. I think this is what PiAlign basically does in terms of keeping that awful ringing to a minimum. I've also found that the frequency Fs is kept about -10db down from where the subwoofer is flat in most cases in PiAligned cabinets. Most sealed systems (Qtc=0.707) generally arn't used near resonance either, just like a PiAligned cabinet. I realize that in the Acoustic Suspension vs. Bass Reflex post, you've made the point that port dampening is used on a PiAligned cabinet to reduce the ringing at resonance. Your probably right, but I'd like to know why this is so. Most say that in sealed systems, the air in the box is very stiff and is the best at impeding resonance overring. I guess we could describe damping by the impedance curve? If I recall, the higher the impedance peaks, the higher the system damping. I dont know if this relates to the damping at resonance however. I think the distance between the peaks also has an effect, but I'm not sure of what this does. I guess the question is, a PiAligned box and a Qtc=0.707 box have almost the same response curve (but PiAlign has a bit more bass extension which is good) I'd like to understand why the port makes the ringing at resonance less in a PiAligned box than a Qtc=0.707 sealed box. They are both small and used way away from resonance. I dont diagree with you, but I'd like to understand a bit better :-) That stuff above just came up in my mind when I was thinking of my real question. Besides resonance overring, along the subwoofers passband there is phase shifts, of course. And those phase shifts describe group delay, which is a difference in time. I've found that plugging the numbers into a box modelling program for a PiAligned box and a Qtc=0.707 box, that the phase shifts within the passband (I compared from the -3db point of the sealed system and up to 100Hz. Then I used the sealed systems -3db point to 100Hz, except on the vented system, instead of the vented systems -3db point which is a bit lower and hence a bit more phase shift) for both systems are just about the same. They came out to be about 10 to 40 degrees different in most cases. I think that this is just about nothing, is that right? So I then looked at the group delay curves. (By the way, I used the T/S parameters for the Eminence LAB12 for this discussion, for no reason. Have to pick some woofer to discuss :P ). The vented systems group delay was slightly higher than the sealed one, which I expected as the PiAligned box had a slightly bigger phase shift than the sealed system. But it was not much at all. Would it be fair to say that a PiAligned box and a sealed Qtc=0.707 box, in terms of "group delay" throughout the passband - are equal, disregarding the tiny phase shifts of even like 40 degrees, which do our ears cant discern. So they are equal in this respect. Now the resonant phenomonen, you've said that the PiAlign cabinet has less resonance overring. Cool. So in terms of all this "crap stuff" like group delay, resonance overring, etc, a PiAligned box has no more audible group delay than a sealed box, but it does have less resonant overring, which makes it better in this respect. Correct? Man, this has taken a while to write. I'm not even sure if I've asked what I was trying to do in the first place! The Adire Audio DPL12 is a 12" woofer, with a very low Fs of 16Hz. For resonant overring to occur, the signal must have information right at box tuning frequency, or very near it. How far away would

you say the maximum is before resonant overring does not occur? Say if Fb=20Hz, and we had a song with no information below 30Hz - can we say that resonant overring wont occur? And could we then say, for any vented box of any size will sound the same as a PiAligned one because theres no information at resonance to excite it into ringing? That is of course, any box that doesn't introduce absolutely huge phase shifts. Tuning the box lower or making it larger means that the group delay is maximum at a much lower frequency. I compared the phase shift between 20Hz and 100Hz on the Adire DPL12 for a PiAligned box (58L, 15Hz Fb), and then a much larger 5ft^3 box tuned at 16Hz. The PiAligned box had more phase shift, but it had lower group delay. I have thought that, the more phase shift, the higher the group delay. Whats happening here? True Audio also has an interesting paper on group delay if you want to check it out. Phase should be kept to a minimum for the original recording to be most properly reproduced (and therefore group delay too), providing the response curve is flat of course. I was going to say something about this, but I've forgotten it. I think it might have been how many cycles are allowed before group delay becomes a problem in the bass range? True Audio says 1-2cycles at maximum. BTW: Is one cycle 360 degrees? Is there a way to define a "cycle" using group delay, which is measured in milliseconds? Thanks!AdrianPS: Sorry for making it such a long post!