Subject: Voice Coil Inductance
Posted by Adrian Mack on Fri, 29 Aug 2003 23:32:25 GMT
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Hi all,I'd like to ask a question about driver voice coil inductance, Le. I have heard that it is an indicator of transient response in terms of responding to a signal, because the driver acts as an inductor and larger inductance values hold the signal for longer before releasing it. I'm not sure if its a constant delay with frequency though.Also inductance can be important to a passive crossover. But I see people boasting very low Le's - I'd like to know, what is the actual importantance of this. I've heard woofers with Le values of 4 that are excellant. So if anyone knows the actual real story behind voice coil inductance - I'd like to hear it!Thanks!Adrian

Subject: Re: Voice Coil Inductance
Posted by Wayne Parham on Sat, 30 Aug 2003 02:21:59 GMT
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Voice coil inductance is just a physical property of the motor. There are some things that tend to raise inductance and some things that tend to reduce it. But generally, drivers that are tuned lower tend to also have more voice coil inductance.One might say that a perfect motor would be one that exhibited a pure resistance as a load. This would certainly be easier to design crossover filters and amplifiers for, at least if flat frequency response was desired. But that's sort of like talking about a "frictionless motor" - If you don't have friction then there is no drag to reduce efficiency and power, but there is also no way to transfer power because there is nothing to "push against."So I guess it really boils down to whether you view the issue reductionistically or holistically. If you look at voice coil inductance all by itself, you will find some issues that present themselves. But when you look at the system as a whole, voice coil inductance becomes just one factor of many, and it becomes less of an "advantage" or "disadvantage." That's just the way a motor is, and it is one of the speaker's properties. "Intended use" really dictates what is suitable for this property as it does many of the others.

Subject: Re: Voice Coil Inductance
Posted by Adrian Mack on Sat, 30 Aug 2003 03:27:23 GMT
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Hey Wayne,Adire Audio, in their technical notes section has an article on voice coil inductance. Its located at http://www.adireaudio.com/tech_papers/woofer_speed.htmIf you have the time to read it, can you please go through it and tell me your thoughts. Its really just making a simple point, but a point nonetheless. If we go by what that article has to say on inductance - that it holds the signal for a bit then "lets it go" (which is basically what inductors do) - do you think that the motor acting

as an inductor will hold low frequencies for longer than high frequencies? Or would it act sort of like a constant delay like a flat GD curve?I believe there are some that place all this emphasis on voice coil inductance, but they dont even know what it is. Thats why I'd like to get a better picture of this aspect. BTW: On DVC woofers - wiring the VC's togethor in series doubles Le, and parallel halves it. I guess thats because in series the wire length is seen as doubled (which explains why Bl is doubled with series wiring). In parallel, for some reason it doesn't affect BL at all... Siegfried Linkwitz says on his website that wire length is not made any longer or shorter in parallel so BL is not affected in parallel wiring. But parallel wiring does halve the Le value. Why is this? Linkwitz also said voice coil inductance has little influence on low frequencies.... is this true? If so, then... we could say that for subwoofers, Le is not important. And on midrange/high frequency units inductance is always going to be low anyway, because they are tuned higher, so its not important to know what Le is on these units either. Or is this too simplistic?Thanks!Adrian

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Subject: Re: Voice Coil Inductance
Posted by Wayne Parham on Sat, 30 Aug 2003 05:34:47 GMT
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I'll have a look at the papers you suggested as soon as I have a spare minute. I'm guessing the Adire tech sheet probably discusses things like Faraday rings and the like. I was impressed with this flux stabilization ring when JBL began using it to reduce second and third harmonics in the late 70's as they replaced alnico magnets with ferrite structures. They called it "Symmetrical Field Geometry" (SFG) and every driver in the Professional Series SFG, VGC and SVG lines have used this ever since.Seems like I heard the Adire folks have begun doing the same thing these days, which leads me to believe they're using Eminence motors like are used in the Magnum series as their base design. If memory serves, Adire uses Eminence as their OEM source, so it follows that they would do this - The Magnum motors also use this technology. Eminence makes great products, so I was very happy to hear that they had begun to incorporate a flux stabilization ring in their new product offerings.

Subject: Re: Voice Coil Inductance
Posted by Adrian Mack on Sat, 30 Aug 2003 06:55:35 GMT
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Thanks I look forward to your response.I dont think Adire have used flux stabalizing rings in their woofers. I've looked around their stuff quite a bit and have found no mention of it. But in their latest Brahma and Tumult woofers they use a thing called XBL2 which keeps a very flat BL curve along its entire 30mm or so excursion. Adire is distributing Eminence products for quite awhile now. CheersAdrian

Subject: Re: Diaphragm Mass
Posted by Wayne Parham on Sat, 30 Aug 2003 18:44:35 GMT
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I think Adire combines an underhung voice coil with something very similar to the symmetrical field geometry design, don't they? Wasn't that the thrust of their "XBL2" design approach? It seemed to me that they were also using a flux stabilization ring, but if not, that would probably offer additional improvement.At any rate, I scanned the link and while I haven't read it thoroughly, I'd like to comment on the few things I noticed. There are several companies that promote high-mass woofer designs, and this is clearly a good way to make the system tuning lower and get extended bass response. There is merit in this design choice for low frequency applications.But it also means that back-EMF will be increased because the motor must be stronger to have control of a heavier cone. This means that total system damping requirements go up. The motor can be made stronger only if the drive circuits are too. So the use of such a design requires larger and larger current sources, i.e amplifiers and cables, since the system includes the drive circuits.This discussion isn't related to transient response. Nor is the subjective "speed" thing related to cone mass. But what is at stake here is system damping, which determines the response curve. The mass/motor system has a balance of strength to weight, and strength is not only a function of the voice coil and magnet, but also the drive circuit that sources and sinks current for it.In other words, the choice of amplifiers becomes more significant as the mass of the woofer goes up. High-mass woofers aren't suitable for low-power amplifier designs. This is really important for SET and other tube amplifiers, but not necessarily limited to them only. As the woofer is made more massive, the list of suitable amplifiers and sound systems will begin to shrink to only those with very high current sourcing and sinking capacity.

Subject: Re: Diaphragm Mass
Posted by Adrian Mack on Sat, 30 Aug 2003 21:35:07 GMT
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Hey Wayne,Adire Audio describes XBL2: "Adire Audio has developed a new patent pending

excursion, with typically no net increase in production cost. The flatter BL curve meanslower distortion (see Dr. Wolfgang Klippel, et al)."What they do in XBL2 is use a voice coil which is short like an underhung design. They also say the XBL2 has lower inductance and lower moving mass. Distortion is reduced because BL curve is more linear and there is a more constant motor force and high excursions. On a graph they showed the Underhung voice coils were second best, but Adire's XBL2 was the best in terms of the BL curve being flat over a large range. It also had the least distortion, but of course there are other ways to lower distortion as well etc. The lowered

inductance would seem to be a result of copper shorting rings, however Adire dont state this at all and say its a result of XBL2. Maybe they just want to make it sound like something that only they know how to do :P. After all it is patent pending and they state that so they look cool. The main point of the Adire article on Inductance is that its related to transient response in terms of how quickly it responds/starts to a signal, and not how long it takes for it to stop (which I guess is overring which is also transient response). They say moving mass has nothing to do with how quickly it responds to a signal, and they also say it has nothing to do with transient response. I think mass is related to transient response because it makes up Qms and therefore Qts, but that describes how quickly it stops after the signal is removed. They said the reason why inductance does that is because inductors like to store energy in the magnetic field. They say inductors dont like to have the current change through them. That they like to hold current constant. So they are saying the bigger the inductor the longer it will hold the signal before actually making sound, or it will hold longer before the current starts to change. And they make the conclusion that motors with higher inductance will hold the current longer so it takes longer for it to make any sound. But thats all in terms of responding to a signal and not stopping it. Do you think Adire's analysis is right? If it is, do you have any idea on what you would call a "too high" value? Perhaps like you said inductance is just one of many parameters and is pretty useless. Adire Shiva is DVC and each VC is 4.2mH. If you wired the coils in series you get 8.4mH. Is there a reason why series wiring of the VC's on a DVC woofer should be avoided then? Is it because inductance gets way to high? The thing is, I'm not sure just how much effect inductance really has. The Linkwitz note is in the "FAQ" section of his site, its frequently asked question number 12. He doesn't say much except "I will ignore the voice coil inductance which has little influence at low frequencies". And then he just goes on to talk about BL for a bit. Anyway, I'd like to hear what you think when you have the chance to respond. BTW: I've started the tower enclosures for the horn/jbl woofer main speaker thing, I had to pay about $100 more because I could only order pre-veneerd MDF in huge 2.4x1.2m sizes :P Thanks!Adrian

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Subject: Re: Diaphragm Mass
Posted by Wayne Parham on Sun, 31 Aug 2003 05:33:59 GMT
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Both mass and inductance are properties that describe something that stores energy. Mass stores kinetic energy and inductance stores magnetism, which acts to store current. Since both of these represent something that stores energy, then both represent things that are resistant to change.These are properties that are interrelated with others to form a system. Response and damping are two things that are affected when mass or inductance change. And raising mass makes the system have more inertia, so it will either take more energy to accelerate or given the same amount of energy, it will accelerate slower.But since the motor can be extremely powerful, mass by itself is not a determinant. It's a part of the equation. Same thing with inductance - It will form a phase relationship with respect to other reactive and resistive components in the system, which also has an impact on response. But again, it is one part of the equation.Still, the point you make is well taken. Both mass and inductance represent properties that require energy to set in motion. If this energy is fixed, then raising mass will make the system more sluggish and raising inductance will make a system slower to charge.

Subject: current sink/source
Posted by toxicport.e on Mon, 01 Sep 2003 18:43:47 GMT
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how can one know what amp is suitable in this respect?can you define current sinking? is this refering to back emfs being induced in VC being 'dumped' in the amp/?the ability of the amp to sink current to ground?Thanks!_Mike

Subject: Re: current sink/source
Posted by Wayne Parham on Mon, 01 Sep 2003 19:18:36 GMT
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The amplifier tends to act as a short circuit to back-EMF from the woofer. Output impedance is effectively a series resistance. So you can simulate the effects of increased amplifier output resistance by adding series resistance in the woofer circuit.