Subject: Back EMF; Good or bad thing?
Posted by Adrian Mack on Sun, 29 Jun 2003 11:16:13 GMT
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Hey Wayne,Just letting you know I've done heaps more research and found answers to a lot of my questions in my previous post. I have only questions on Back EMF/Damping Factor now, and I have two different views I've found on them, and I am unsure of which is correct. The first view, is from a document on a Crown amplifier, it actually states more Back EMF as being a good thing. It states that Back EMF is generated from the voice coil itself, which I think its right. It then says it travels through the speaker cable back to the amplifiers ouput, then returns back to the speaker. Because Back EMF is opposite in polarity with the speakers cone motion, it stops/suppresses the speakers ringing. I dont think this is completely right. It then later says the smaller the amps output impedance, it will not stop the Back EMF, instead it will let it through which damps/stops ringing in the speaker, because as the speaker cone moves out, the back EMF makes it move back in, and vice versa. My understanding is that Back EMF is a voltage generated by the loudspeaker itself, and bigger motors/drivers and/or heavier cones produce more Back EMF. Thats because the heavier cones are less controlled and more kinetic energy is needed to move them, hence more Back EMF. Because the cone is less controlled, Qms will be rather high, which also means higher Zmax. Back EMF is bad, because it means the cone will keep ringing after the signal is stopped. So that means that amplifiers with high damping factors are needed as they stop the Back EMF from going back to the speaker hence stopping the ringing, especially with high Zmax speakers which have poorer cone control. So you can see I have a problem, and I cant solve it! Which is right?! Can you offer any advice?Thanks!Adrian

Subject: one other thing...
Posted by Adrian Mack on Sun, 29 Jun 2003 11:38:36 GMT
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Back EMF isn't actually damaging to amplifiers, right? This is just something I picked up fromt he web, but its probably wrong. Another thought that occured to me, because midrange and tweeters dont produce anywhere near as much back emf as woofers do, its not so important to have an amp with high damping factor for midranges/tweeters as it is for a woofer which produce more Back EMF?

Subject: Re: one other thing...
Posted by Adrian Mack on Sun, 29 Jun 2003 11:42:20 GMT
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Oh yea, when I say wrong, I mean that it doesn't harm the amps, because I've seen some stuff on

the net that says it does, but I think that it doesn't. Hopefully this is the last stuff-up post I'll make lol. I appreciate any help :-)

Subject: Motor braking
Posted by Wayne Parham on Sun, 29 Jun 2003 12:06:25 GMT
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You've got the gist of it. Back EMF generated by the speakers will cause current flow through the circuit. Inertia is the energy that drives the voice coil to become a generator. If the amplifier is a good current sink, then it is very nearly a short circuit and it will make the generator do more work because more current will flow. This will slow it more effectively, and that's why it is called damping. I've referred to this as "motor braking" because that's what it is.This is good because it allows more powerful motors and therefore larger loads in the system. Cones can be made more massive and still be well-damped. Motors can be made more powerful. But this requires that the amplifier act as a very good current source and sink, because current is directly proportional to motor strength. That's the down side.So there's the rub. In and of itself, motors that generate a lot of back EMF have strong motor structures and that's a good thing. But if the amplifier isn't a good current source/sink, then the motor isn't strong after all - It's just massive and weak. So if the amp has poor damping ability then a woofer that needs motor braking will perform poorly. Qes will change dramatically and the system won't perform as expected.One other thing - Consider what happens in a circuit containing transformers (or autotransformers) when back EMF is applied. Tube amplifiers are generally less able to deal with speakers that need motor braking, and this is largely because they have output transformers and have relatively high output impedance.There are also speaker designs that use autotransformers in the crossovers, and so it is important to consider this if woofers are installed that generate a lot of back EMF. And also watch out for piezo tweeters, since they are a high impedance capacitive load. I've actually heard a few installations where back EMF from a woofer caused the piezo to chirp, even on amplifiers with exceptional damping ability.

Subject: Re: Motor braking
Posted by Nelson Bass on Sun, 02 Dec 2012 17:20:13 GMT
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Hi Wayne,

If I understand you correct it is a no go to use autotransformers for adjustment tweeter level if one is using a common amp to driver both the tweeter and the woofer?

A friend had positive experiences replacing resistor L-pads with autotransformers for his

compression drivers in his multi horn system but he do have a separate filter and amp for the woofers...

Subject: Re: Motor braking
Posted by Wayne Parham on Mon, 03 Dec 2012 07:04:55 GMT
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It's more complicated than that, but autotransformers do provide impedance matching, whereas resistors simply impede current flow. The impedance interacts with the output circuit (tube/transformer) in the amplifier, which ultimately is the thing that provides the most electrical damping.

I think the most important thing to consider is the fact that low-power tube amps cannot provide much damping, so a loudspeaker that has wild impedance swings will cause frequency anomalies because of the voltage division between load and source impedance.

Subject: Re: Motor braking
Posted by chrisR on Mon, 03 Dec 2012 18:32:09 GMT
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Hi Wayne,
A couple of silly questions then...
If Qes is dependent on the amp you are connecting a driver to, then what assumptions are behind the driver's specs in this area?

And then when picking drivers for use with tube amps, we're generally looking for more efficient speakers, which tend to have stronger motors, which exacerbates the issue, or lighter mass which helps the issue... It still seems like there's an opportunity for a driver selection optimizer thingy to sort ot these engineering trade-offs.
Thx, Chris

Subject: Re: Motor braking
Posted by Wayne Parham on Mon, 03 Dec 2012 19:14:11 GMT
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I should clarify that driver Qes doesn't actually change (obviously) but the behavior is the same as if it did. If you add series resistance, then it has an effect just like Qes was increased. And Qes has the largest impact on Qtc, so this is fairly significant.

Series resistance is increased by the speaker cable and any coils in the crossover network, as well as by the output impedance of the amplifier.

As for the driver itself, high-efficiency designs do typically have strong motors and relatively low Qes. But this isn't always the case, especially the inexpensive cast-frame drivers. But as a general rule, the better drivers have low Qes. In fact, many have such low Q they don't develop much bass in anything but the largest boxes. This is OK though, since most of our speakers are used with subs.

We used to discuss this a lot. Do a search here for "Zmax" and you'll find lots of posts that talk about high-Q motors and tube amps. They're usually not a good match.