Subject: Re: Origins of Power
Posted by Wayne Parham on Sun, 28 Nov 2010 16:47:58 GMT
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Loudspeakers are moved by the interaction of the fixed magnet and the voice coil's magnetic field. The voice coil is an electromagnet and its strength is directly proportional to current. Current is directly proportional to voltage, so you can really talk about either, if you disregard impedance fluctuations.

The impedance curve is what makes things a little bit complicated, since the resistance of the wire, output impedance of the amp and any insertion losses in the crossover all create a series resistance which forms a voltage divider with the loudspeaker, and this can create response anomalies. There is a filter function in the transfer curve as a result.

Most people familiar with the basics of loudspeakers expect a coil to impart a low-pass transfer function, a capacitor to make a high-pass curve and a coil and capacitor to create a band-pass bump. But what is counter-intuitive to many hobbyists is how a pure resistance can also create a filter function.

resistor in series to lower the SPL output, you would expect 6dB drop in output, right? That's true

region, where the diaphragm's mechanical resonance "bucks" the drive current and increases

now, with the driver getting more voltage across it. The reduction in SPL output is now only 2.4dB, much less than the 6dB drop across the rest of the band. So it gets a bump in response at resonance, one that is quite easily measured and definitely audible.

The documents below go into this in more detail. The "Crossover Electronics 101" handout is what I use at my audiofest seminars, and it's a handy cheat sheet of forumulas. It also shows the circuits we hook up during the demonstrations, and the response curves they generate. We listen to music played through those circuits, so you can hear what they sound like and compare that to what is shown on the graphs. Lets people get an idea about what audible effects are produced and how a graph "sounds". And the "Speaker Crossover Document" is a study/demonstration document that shows various crossover circuits employed in loudspeakers, particularly those used in constant directivity and waveguide designs. It has become kind of the reference for all of us building what are now often called "waveguide" loudspeakers.
Crossover Electronics 101
Speaker Crossover Document