Subject: Horn phase
Posted by Wayne Parham on Mon, 15 Sep 2003 07:22:19 GMT
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I think it was good to point out the distinction between acoustic impedance and electrical impedance. There is a reflection of acoustic impedance in the electrical impedance though, through the mechanical system. The acoustic load modifies the mechanical load which then in turn causes an effect in the electrical load.

The best examples are those that that are highly loaded acoustically, i.e. horns. I've noticed that horns exhibit electrical peaks where the horn's acoustical load becomes more reactive. The acoustic phase angle of horn forms a rippled curve, which is caused by the changing acoustical reactance and resistance. It acts very much like a series of resonators and as such, generates ripples in the acoustic impedance curve. These are translated into the mechanical system and, in turn, in the electrical system. So while acoustic impedance is not the same thing as electrical impedance, there is some inter-relationship between the two.

The relationship between phase and impedance is determined by the following formula:

where,

i is the imaginary or reactive impedance, and
r is the real or resistive impedance

Considering this, you can easily find the phase where impedance is known.

So let's look again at the response chart for a horn:

You can see that the horn is intended to be used from 40Hz to 400Hz, so that's the region of interest. You'll notice that the device is quite reactive, meaning that it has non-zero phase. And it

at 200Hz and 20° at 400Hz, where the horn has reached upper cutoff. Phase isn't consistent either, but instead is a series of ripples representing large closely-spaced changes in phase. You'll find this reflected in the electrical impedance, where you'll see ripples in the impedance curve.