Subject: tractrix horn/driver throat matching
Posted by Thomas Agerbaek on Fri, 11 Nov 2005 08:33:39 GMT
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Hello PISpeakers Forum, I'm putting JBL 2445 and 2426 compression drivers on circular wooden tractrix horns integrated into the baffle of the cabinet.The 2445 horn mouth is 240mm (ca 9.5in) dia, the 2426 horn is 110mm (ca 4.5in) dia.The problem is, the drivers' throats are conical, with exit angles of about 5 degs. However, the contours of the above tractrix horns will have throat entry angles of some 12 degs at the corresponding diameters (1in and 2in).This means that there is an abrupt change in the flare rate at the junction. Intuitively this is not good, because it would lead to jumps in the acoustic impedance, reflections, etc.It would be much better to have the angles matched, but this would entail making compromises wrt the tractrix contour, by departing from the mathematically correct curve.Any input which could help me make an informed decision as to the best compromise wrt the horn countour would be greatly appreciated.TIA Thomas

Subject: Re: tractrix horn/driver throat matching
Posted by Wayne Parham on Fri, 11 Nov 2005 13:16:22 GMT
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You can model the horn in Hornresp with abrupt transitions to see what you can expect. You can also radius the interface between conical and tractrix sections and measure the results and compare. The final shape may be something like a quadratic throat with mouth exit radiused like a tractrix, so you may want to do some research on the quadratic throat design. There's an introduction at the link.

Subject: Re: tractrix horn/driver throat matching
Posted by Thomas Agerbaek on Sat, 12 Nov 2005 16:56:20 GMT
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Wayne, thanks for the info.1. The quadratic horn paper was right on the money. Thanks.2. I tried the hornresp program, but it appears to be directed to hornloaded cone divers, with TS parameters etc. How do you make a compression driver fit into that?TIA Thomas

Subject: Re: tractrix horn/driver throat matching
Posted by Wayne Parham on Sat, 12 Nov 2005 17:34:23 GMT
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To know the electro-mechanical parameters, you'll have to either contact the manufacturer or measure them yourself. Also be aware that compression drivers have a phase plug which cannot be modeled in Hornresp and that almost all compression drivers operate in breakup mode for the top two octaves which also cannot be modeled. There is a way to model directivity, but it is simplistic and so you'll probably want to also consider that you'll be looking at power response, not on axis response. All these things will affect simulation at high frequencies. But when you're looking at the possible anomalies that a flare transtion might cause, Hornrsp is a great place to start. Once you've found some horn profiles that are free of peaks and reflections in the simulations, you can make physical models and measure them to know what effects the phase plug, diaphragm resonances and collapsing DI have, particularly in the top couple of octaves.

Subject: Re: tractrix horn/driver throat matching
Posted by ivicai on Thu, 11 Mar 2010 17:08:05 GMT
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hi,
I have tried to do something similar having i mind mentioned 5 deg
angle from the driver 2445/6
You can try with my data.

File Attachments

1) Quadratic_49mm.xls, downloaded 469 times

Subject: Re: tractrix horn/driver throat matching
Posted by Wayne Parham on Thu, 11 Mar 2010 17:43:54 GMT
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Well, that's exactly right. You really want the entry angle of your horn throat to match the exit angle of your compression driver.

You have a problem that doesn't have a good solution, I'm sorry to say. If your horn entrances are already exactly 1" and 2" diameter, as they should be, then you cannot easily make adapters that provide a flare match. That's what you want - to start at the driver exit angle and end at the horn entrance angle. Both entrance and exit are already the same size, so there is no way to make an adapter with a radiused expansion to match one with the other.

What I might suggest is to have the horns cut so you can make a proper adapter. Transition the conical section of the driver with the tractrix entrance using an adapter that is contoured to have a gradual transition and no abrupt change in area. The curve you choose is up to you - some would say stick with tractrix, some would want oblate spheroidal, some might prefer a quadratic.

Since you've already chosen tractrix, you may want to try and stick with that shape although the fact that you're matching an existing section with another that will ultimately be slightly longer will preclude that. My advice is that it is better to remove the abrupt change in shape with any gradually radiused shape than it is to leave the abrupt change there. Use an oblate spheroidal, tractrix or simple radius, anything smooth is better than a sharp change. If you want it perfect, you'll have to start from scratch, but I think an adapter with a nice radiused transion will get you 99% there.