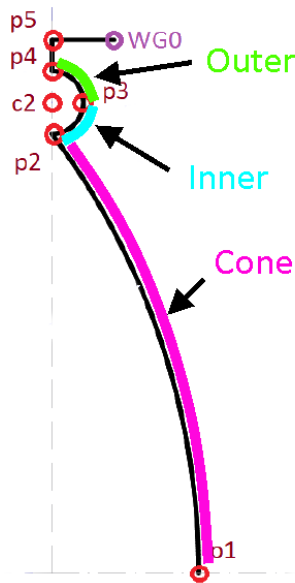


Calculating Radiating Element Weights for Dome Tweeters

J. Carothers 11AUG2020

This document outlines a method for calculating weight constants for radiating surfaces for dome tweeters, as simulated in ATH4.6. It assumes that the tweeter driving elements have been modelled in three parts: the cone, the inner portion of the surround, and the outer portion of the surround. An example is included in ATH4.6 as "demo7." For more info on how to model dome tweeters in this way, refer to the ATH4.6 User Guide Appendix B.



Input Variables:

S_d = the effective piston area, listed in the data sheet of the tweeter

r_c = the radius of the cone element

r_s = the radius to the outer edge of the surround

Calculation:

Start by calculating the radius (distance) from the center axis to the midpoint of the surround, r_m :

$$r_m = \frac{r_c + r_s}{2}$$

Next calculate the areas (as projected onto the XY plane) of the three driving elements: the cone A_c , the inner portion of the surround A_i , and the outer portion of the surround A_o :

$$\begin{aligned} A_c &= \pi r_c^2 \\ A_i &= \pi \left(\frac{r_c + r_s}{2} \right)^2 - A_c \\ A_o &= \pi r_s^2 - A_i \end{aligned}$$

The effective piston area listed in the data sheet should match the sum of all driving areas in the BEM mesh, weighted by their acoustic radiation constants w_n . Note that the cone is assumed to have a weight of 1.0, due to its assumed fully-pistonic motion:

$$S_d = A_c + A_i w_i + A_o w_o$$

Consider the cone a rigid body that is displaced along the Z axis. If we assume a linear decay of displacement across the width of the surround (from r_c to r_s), it can be shown that the air displaced by the inner portion is 3 times as great as the outer portion, and therefore radiates 3 times as much:

$$w_i = 3w_o$$

Rearranging the above equation, we can solve for the constant w_o :

$$w_o = \frac{S_d - A_c}{3A_i + A_o}$$

Now both constants w_i and w_o can be calculated and used in the BEM simulation.