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Subject: Electro-mechanical formulas ( Thiele / Small )

Posted by [Wayne Parham](#) on Mon, 05 Jan 2009 00:31:33 GMT

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I stopped maintaining the VadCalc applet. It was written in a weird little language called CA Realizer (Computer Associates), which I also used to write tubing movement programs for the oil and gas industry. I do most of my programming in C++, but that language was easier to use for some things, so I gave it a go for a while. I assume you want to use it because you don't want to build a box to find Vas with the sealed box method. If that's the case, I suggest the added mass method. Then again, I understand the desire to have a method that works without two impedance sweeps. The VadCalc process was simple to do, and provided a pretty good estimate of Vas. Here's a formula that you can use to calculate Vas, knowing efficiency  $\eta$ ,  $Q_{es}$  and  $f_s$ : More woofers specs list the SPL output at 1W/1M than reference efficiency, so here's a converter: These days, I use Keith Larson's Woofer Tester and Speaker Tester products. They really make life easier. It has evolved a long way since the original Woofer Tester that he used to sell through Parts Express. You can use it to do acoustic measurements and make a digital crossover using Spice models to simulate passive crossovers. It's a great tool. And it still does the T/S measurements. Smith & Larson Audio! If you want to find T/S specs making measurements manually, or if you want to calculate values from other known values, here's a list of formulas that

constant  
Speaker total Q at  $f_s$   
Efficiency/bandwidth product  
Resonant frequency  
Electrical Q  
System resonant frequency  
System total Q at  $f_c$   
Resonant frequency  
Speaker total Q at  $f_s$   
Half power frequency (-3dB point)  
System resonant frequency  
Internal box volume  
Compliance  
Free air reference efficiency  
Speaker resonant frequency  
Compliance  
Speaker electrical Q  
Sound pressure level  
Free air reference efficiency  
Maximum air volume displaced by cone excursion  
Peak linear displacement  
Diaphragm radiating area  
Volume displaced at  $X_{max}$   
Diaphragm effective radiating diameter  
Diaphragm radiating area  
 $K_1$  constant  
Air density  
System resonant frequency  
Volume displaced at  $X_{max}$   
Speed of sound  
 $K_2$  constant  
 $K_1$  constant  
 $A_{max}$  constant  
Maximum displacement  
limited power output  
 $K_1$  constant  
 $A_{max}$  constant  
Required electrical input to achieve Par  
Maximum displacement  
limited power output  
Free air reference efficiency  
Peak sound pressure level  
Maximum power input