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Section 7.0 : Conclusion

Over the past two years, a number of DIY speaker builders have used the earlier versions of these MathCad models to design their own quarter wavelength enclosures. Many more have built one of the two speaker projects I designed and documented. My ML TQWT design, based on the Fostex FE-164 full range driver, has been a very popular DIY project. All of the feedback that I have received has been extremely positive. Measurements and predictions are reported to correlate very closely.

During the same time period in which I was developing my first set of MathCad models, George Augspurger[14, 15] was working on a lumped parameter model for a fiber filled transmission line. His Audio Engineering Society preprint and Speaker Builder articles appeared at about the same time as my original articles on the transmission line website (www.t-linespeakers.org). While the problem being solved was the same, the calculation algorithms were radically different. Augspurger divided the transmission line into many segments and used a lumped parameter electric circuit simulation to predict the electrical impedance and SPL system response of a driver in a transmission line. Where possible I have made direct comparisons between Augspurger's circuit models and my MathCad worksheets. The results match closely and our conclusions concerning the fibers being stationary agree.

In the preceding sections, four new transmission line MathCad models have been described. These new models carry the same names as my previous models from September of 2000. This was not done by accident, the new models will calculate the exact same results as the previous versions of the worksheets. The improvement in the calculation algorithm allows more complicated geometries and stuffing schemes to be analyzed in great detail. While the earlier worksheets were inflexible and used hard coding for a specific number of sections, the new worksheets allow the user to specify how detailed a model is to be built and analyzed. This may mean 1, 5, 10, or even 100 sections will be included in the model. But since the one dimensional acoustic transmission line element is derived from a closed form solution of the wave equation, only one element is required to achieve an accurate result.

With this increase in modeling flexibility, it also became clear that the one-dimensional acoustic element could be used to model many different types of speaker enclosures. The calculation algorithm has been used to simulate closed box, ported box, back and front loaded horns, and a variety of isobaric designs. The added benefit from this style of model is the inclusion of internal standing waves, along the longest dimension, in the enclosure analysis. These additional enclosure models will also be made available for DIY speaker builders to use as design tools. Changing the MathCad worksheet to simulate even more additional styles of enclosures is very quick and easy. There is plenty more work to be done and presented.

As with any tool, the knowledge and skill of the user determines the quality of the result. Please read the summaries that accompany each MathCad worksheet to understand the assumptions made and the limitations of the models. If questions arise, please do not hesitate to contact me directly. I will do my best to resolve the question. The bottom line is that the MathCad transmission line worksheets really work! At this point, I do not know of any other speaker design tool that can accurately model a variable cross-section damped quarter wavelength enclosure, which is also readily and easily accessible to the DIY community.