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Modeling Acoustic Noise Cancelling Structures with Electrical Analogies

The use of electrical circuit elements to model physical devices has a long history of success. The analogy between flow of air and electrical current is mathematically accurate; momentum of a section of a gas also called Inertance is directly analogous with the electrical parameter Inductance. The compliance of a transmission vessel (hose or pipe) is directly analogous with electrical capacitance. Using these elements combined into a transmission line structure allows the analysis of leaks in the structures, and resonances with a circuit simulator such as SPICE (S.W. Director et al.).
This paper will present preliminary results on the prediction of noise averaging characteristics of distributed input transmission lines such as soaker hoses and collections of end driven tubular transmission lines such as rosettes. Results to be presented include basic models of leaky hoses and end driven pipes with spatially distributed excitation. Resonant effects, attenuation, dispersion and summing of acoustic signals will be presented. The model will be used to compare the effectiveness of two of the current noise cancelling regimes used for Infrasound recording.

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