SINGLE AND PARALLEL BARRIER INSERTION LOSS BY MEANS OF IMPROVED DIFFRACTION BASED MODELS

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Introduction

Lam[1] recently introduced an improved diffraction based method for calculating the insertion loss of a finite length, three dimensional barrier. Comparisons of this new method to experimental scale modeling and wave based boundary element method showed good comparisons over a broad frequency range. This preliminary work of Lam is extended in this paper to include the modeling of two dimensional geometries and other diffraction models, namely the models of Kurtz and Anderson[2], and Pierce[3]. The work is also extended to include the consideration of parallel barriers and the modeling of finite ground impedance.

Lam's diffraction based method for calculating the insertion loss of a finite barrier considers the phase interrelation of each of the minimum diffraction paths from the source to receiver. The diffraction model used with Lam's method was Maekawa's curve. This method considers only the amplitude change of sound at the edge of the barrier. The same can be said for Kurtz and Anderson's diffraction model. Pierce's diffraction model, on the other hand, predicts the amplitude change and a phase shift at the edge of the barrier, hence providing a more accurate prediction model. Figure 1 compares insertion loss of a finite width barrier as predicted by BEM and the diffraction models.

2D Modeling

Lam's method was extended to consider two dimensional geometries for single and double barriers. Results compare well with the boundary element method. In modeling parallel barriers, Pierce's diffraction model was once again found to be superior. An impedance plane model was included for two dimensional geometries. The model incorporated was that of Hothersal's[4]. Comparisons with finite element modeling are shown in Figure 2. The results compare well.

Discussion

Accurate 2D and 3D boundary element models require extremely large amounts of computer memory and computational time. Simple diffraction based models, like those discussed here, take only a fraction of the computational time and require minimum computer resources. This enables these methods to be used as an accurate, efficient design tool to conduct frequency response tests, both discrete and octave band and even full contour mapping over large regions.

Continuing Work

To this point, all the models have considered a uniform atmosphere. This greatly overpredicts the performance of barriers. Work is currently being conducted to consider the effects of a non-uniform atmospheric medium, such as a wind/temperature gradients and turbulence on barrier performance.

References

1. Lam, Y. W., Using Maekawa's Chart to Calculate Finite Length Barrier Insertion Loss. *Applied Acoustics* **42** (1994) 29-40
2. Kurtz, U. J. and Anderson, G. S., Sound Attenuation By Barriers, *Applied Acoustics* 4 (1971) 35-53
3. Pierce, Allan D., Diffraction of Sound Around Corners and Over Wide Barriers, *J. Acoust. Soc. Am.* **55** (1974) 941-955
4. Chandler-Wilde, S. N., Hothersall, D. C., On the Green Function for Two-Dimensional Acoustic Propagation Above a Homogeneous Impedance Plane, Research Project, Department of Civil Engineering, University of Bradford. UK.

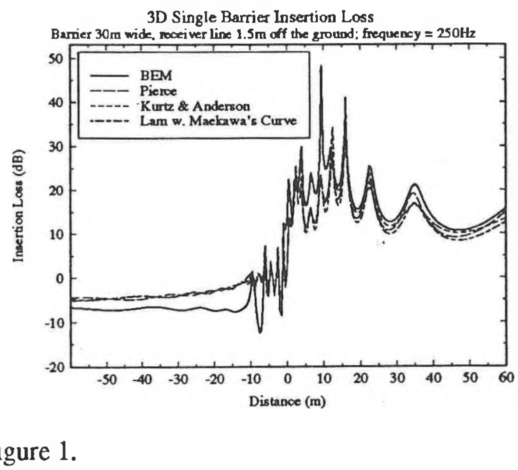

Figure 1.

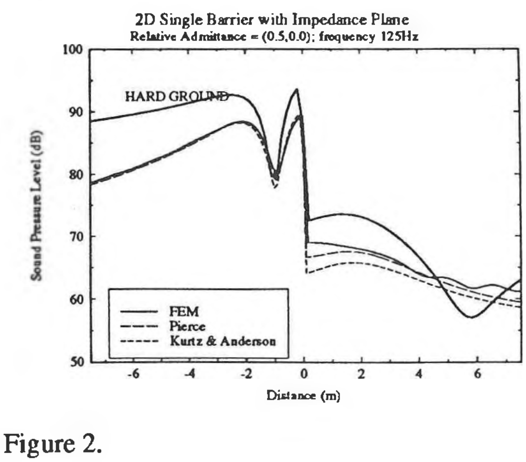

Figure 2.