11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

A PROCEDURE FOR THE TOP GEOMETRY OPTIMIZATION OF THIN ACOUSTIC BARRIERS

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Key words: *Thin noise barriers, Shape optimization, Genetic Algorithms, Dual Boundary Element Formulation*

This work aims at assessing the acoustic efficiency of different thin noise barrier models. These designs frequently feature complex profiles and their implementation in shape optimization processes may not always be easy in terms of determining their topological feasibility. A methodology to conduct the shape design optimization of thin cross section acoustic barriers by idealizing them as profiles with null boundary thickness is proposed (see Fig. 1). Such simplification of reality greatly facilitates the geometric definition of barrier profiles, having no major influence on the acoustic performance. According to previous work [1], the procedure presented herein is based on the maximization of the *insertion loss* of candidate profiles proposed by an evolutionary algorithm. As application, numerical simulations of the performance of two different top barrier configurations of practical interest (Fig. 1) are conducted by use of a 2D code based on the Boundary Element Method (BEM). The special nature of these sort of barriers makes necessary the implementation of a complementary formulation to the classical boundary element method. The inclusion of an additional BEM formulation (hyper-singular) combined with the classical one (singular) provides a compatible system of equations that allows the problem to be solved [2]. Results obtained show the usefulness, flexibility and versatility of the proposed procedure.

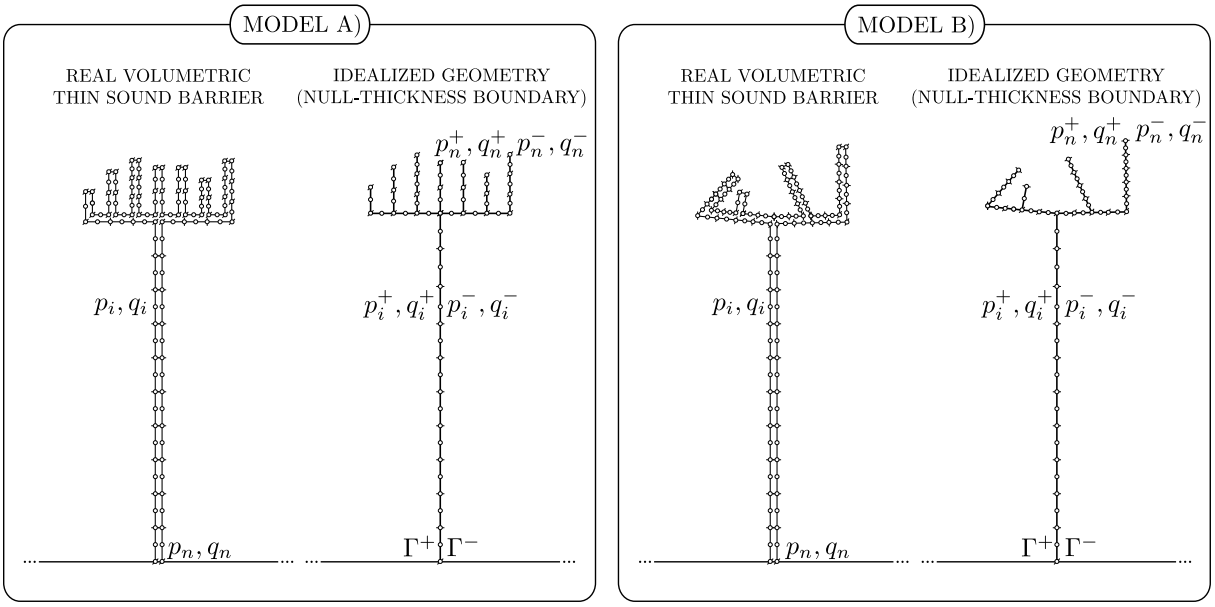

Figure 1: Convenience of representing real volumetric structures as idealized geometries featuring null-thickness boundaries. Left, example of model A) boundary discretization. Right, example of model B) boundary discretization.

REFERENCES

[1] D. Greiner, J.J. Aznárez, O. Maeso and G. Winter. Single- and multi-objective shape design of Y-noise barriers using Evolutionary computation and Boundary Elements.*Advances in Engineering Software, Elsevier*, Vol. **41**, 368–378, 2010.

[2] L. de Lacerda, L. Wrobel and W. Mansur. A dual boundary element formulation for sound progagation around barriers over an impedance plane. *Journal of Sound and Vibration*, Vol. **202(2)**, 235–247, 1997.