Asymptotic modelling of the wave-propagation over acoustic liners

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We will consider the acoustic wave propagation in a channel separated from a chamber by a thin periodic layer. This model stand for micro-perforated absorbers which are used to supress reflections from walls. Due to the smallness of the periodicity a direct numerical simulation, e.g. with the finite element method (FEM), is only possible for very large costs. Based on homogenization techniques we find impedance transmission conditions [1], which integrated into numerical methods like the FEM or the boundary element method leads to much lower computational costs. For liners of finite length their endings have a significant impact to the macroscopic absorption and this effect is a-priori not considered with the transmission conditions. We aim to describe the interaction of the thin periodic layer with the singularities from its endings asymptotically when the periodicity and layer thickness δ tend to zero [4]. For this, the Kondratiev theory for corner singularities (which is based on the Mellin transform) has to be extended to infinite cones with periodic layers [3] in the spirit of Nazarov [2].

References

[1] X. Claeys and B. Delourme. High order asymptotics for wave propagation across thin periodic interfaces. *Asymptot. Anal.*, 83(1-2):35-82, 2013.

[2] S. A. Nazarov. Asymptotic behavior of the solution and the modeling of the Dirichlet problem in an angular domain with a rapidly oscillating boundary. *Algebra i Analiz*, 19(2):183-225, 2007.

[3] B. Delourme, K. Schmidt, and A. Semin. On the homogenization of thin perforated walls of finite length. *Asymptotic Analysis*, 97(3-4):211-264, 2016.

[4] B. Delourme, K. Schmidt, and A. Semin. On the homogenization of the Helmholtz problem with thin perforated walls of finite length. *Submitted*.