



## **An Acoustic Hypersingular Boundary Element Formulation Including Viscous and Thermal Losses**

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## An Acoustic Hypersingular Boundary Element Formulation Including Viscous and Thermal Losses

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To correctly estimate the behavior of small complex acoustic devices, the inclusion of viscous and thermal losses becomes necessary. Practically all domain losses in small setups take place in very thin layers near boundaries. Finite Element formulations including losses exist where boundary layers need to be properly discretized, adding to the computational cost [1]. On the other hand, meshing of boundary layers can be avoided by using the Boundary Element Method [2,3]. However, the existing Boundary Element formulation with losses relies on the use of tangential finite difference pressure derivatives, which might lead to computational difficulties at low frequencies where the element size is much smaller than the wavelength.

This work presents a new implementation of the acoustic Boundary Element Method with losses, where by means of an extra set of hypersingular tangential derivative Boundary Element equations, it is possible to avoid the use of the troublesome first and second finite difference pressure derivatives in the coupling of the fundamental equations. The new proposed formulation introduces, however, hypersingular integration kernels that require nodal  $C^1$  continuity [4]. These difficulties will be discussed and the new implementation will be evaluated through simple test cases.

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