Applications of time-domain impedance simulations to non-linear liners and sound transmission through perforates

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Time-domain representations of the acoustic impedance of a surface are generally preferred when simulating broadband sound fields and non-linear effects, as these situations are less amenable to the more common simulation methods based in the frequency domain. In this communication, we discuss the use of time- domain impedance representations to tackle two specific applications.

Firstly, the modelling and use of a non-linear response of a liner is discussed. A number of simple models are revisited, including those of Rice and Cummings. The implementations of these models in a finite-difference time-domain method for two-dimensional problems are then discussed. The use of characteristic waves for the implementation of these impedance conditions is also described.

Secondly, the use of time-domain models is generally restricted to the reflection off an impedance surface. Here we consider the transmission through, and reflection from, a perforated plate in the time domain. Starting from frequency-domain descriptions of the reflection and transmission coefficients, the realisation and numerical implementation of the corresponding time-domain model are detailed. The constraints on the transmission and reflection coefficients for the well-posedness of the time-domain model are also recovered. Verification cases are presented as well as an application of this technique to a perforate plate in a silencer.