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General impedance boundary conditions in pseudospectral time-domain methods for room acoustics

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Finite-Differences in the Time Domain (FDTD) are among the most accurate numerical techniques to simulate wave phenomena. The main drawback of FDTD numerical schemes is their computational cost in large scale simulations. The recently developed Fourier Pseudospectral Time-Domain (PSTD) techniques, by approximating the spatial derivatives more efficiently, have improved significantly the accuracy and time costs of the simulations of electromagnetic fields.
As a step towards applying PSTD techniques to Room Acoustic problems, we present here a framework to properly deal with material modelling in terms of generic impedance boundary conditions, beyond the common Perfectly Matched Layer absorbing boundaries. We apply our results to a few representative cases (simple but reverberant rooms) and analyse its performance in terms of accuracy and computational resources. In particular we analyse whether the mild constraints that PSTD imposes on space-time discretization lead to good enough results in Room Acoustic simulations.