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A higher order parabolic equation for predicting in-duct propagation in high frequencies

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Complementary methods are required to predict the in-duct propagation in a large frequency range including the liner absorption and the flow effects. Numerical methods solving the Euler's equations are pertinent for rotational flow but limited to the low frequencies. The Boundary Element Method is applicable in a large frequency range assuming a homogeneous flow. The ray-model is valid in high frequencies but scattering effects are difficult to implement. This paper presents the capabilities of a Higher-Order Parabolic Equation (HOPE) to handle duct propagation in the high frequency range. In contrast with the so-called standard PE and the wide-angle PE, the HOPE improves the accuracy of the solution due to its wider propagation aperture angle, especially close to the cut-off frequency. Several duct propagation configurations including flow and liner are considered. Using a marching algorithm, the HOPE computes in a very short CPU time the sound propagation and represents an attractive alternative to the ray-model in the high frequency range.
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