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The acoustics of short circular holes with finite expansion ratio[1]
DONG YANG, AIMEE MORGANS, Department of Mechanical Engineering, Imperial College London — The acoustic response of a circular hole with mean flow passing through it is highly relevant to Helmholtz resonators, fuel injectors, perforated liners, perforated plates and many other engineering applications. Analytical models for the acoustic response of these holes often ignore the impact of a finite expansion ratio either side, or account for it simply by adding an end mass inertial correction derived from the no mean flow assumption. The vortex-sound interaction within a short hole has been recently shown to strongly affect the acoustic response in the low frequency region. The present study uses an analytical model based on the Greens function method to investigate how the expansion ratios either side of a short hole affect the vortex-sound interaction within it something neglected by previous models. This model is then incorporated into a Helmholtz resonator model, allowing us to consider the effect of a finite neck-to-cavity expansion ratio and the vortex-sound interaction within the finite length neck. Large resistance and acoustic energy absorption performance variations are seen even for small changes in the resonator neck length. Reducing the neck-to-cavity expansion ratio is found to decrease the resonators sound absorption when the expansion ratio is low.

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