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Noise generation by a vortex ring near porous edges: Theory[1]
HUANSHENG CHEN, JUSTIN JAWORSKI, Lehigh University — The noise generated by a porous edge is investigated analytically using a vortex ring source in a quiescent fluid. Use of a vortex ring on a rectilinear path near an edge permits the investigation of scaling behaviors for the radiated acoustic power that are analogous to those derived for turbulence edge-noise. A solution methodology based on Greens functions solves for the time-dependent scattered acoustic field. In the highly-porous limit, the acoustic power is shown to scale with the inverse fifth power of the minimum distance between the vortex path and the edge, and on the sixth-power of the acoustic power on vortex ring speed. The vortex-ring configuration in a still fluid furnishes a more direct theoretical comparison with experimental validation efforts, where corruption of the weak porous-edge noise signal by secondary noise sources in aeroacoustic wind tunnels is avoided.

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