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Steady and Unsteady Aerodynamics of Thin Airfoils with Porosity Gradients ROZHIN HAJIAN, JUSTIN W. JAWORSKI, Lehigh University — Porous treatments have been shown in previous studies to reduce turbulence noise generation from the edges of wings and blades. However, this acoustical benefit can come at the cost of aerodynamic performance that is degraded by seepage flow through the wing. To better understand the trade-off between acoustic stealth and the desired airfoil performance, the aerodynamic loads of a thin airfoil in uniform flow with a prescribed porosity distribution are determined analytically in closed form, provided that the distribution is Hölder-continuous. The theoretical model is extended to include unsteady heaving and pitching motions of the airfoil section, which has applications to the performance estimation of biologically-inspired swimmers and fliers and to the future assessment of vortex noise production from porous airfoils.

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