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The Structure and Noise Reduction Capacity of Owl Down JUSTIN JAWORSKI, Lehigh University, IAN CLARK, NATHAN ALEXANDER, WILLIAM DEVENPORT, Virginia Polytechnic Institute and State University, CONOR DALY, NIGEL PEAKE, University of Cambridge, STEWART GLEGG, Florida Atlantic University — Many species of owl rely on specialized plumage to reduce their self-noise levels and enable hunting in acoustic stealth. In contrast to the leading-edge comb and compliant trailing-edge fringe attributes of owls, the aeroacoustic impact of the fluffy down material on the upper wing surface remains largely speculative as a means to eliminate aerodynamic noise across a broad range of frequencies. Photographic analysis of the owl down reveals a unique forest-like structure, whereby the down fibers rise straight up from the wing surface and then bend into the flow direction to form a porous canopy, with an open area fraction of approximately 70%. Experimental measurements demonstrate that the canopy feature reduces dramatically the turbulent pressure levels on the wing surface by up to 30dB, which affects the roughness noise characteristic of the down in a manner consistent with the theory of flows over and through vegetation. Mathematical models developed for the turbulence noise generation by the down fibers and for the mixing-layer instability above the porous canopy furnish a theoretical basis to understand the influence of the down geometric structure on its self-noise signature and noise suppression characteristics.

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