Abstract Submitted
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Flows Around Oscillating Grooved Spheroids[1] C.W. KOTAS, P.H. ROGERS, M. YODA, Georgia Institute of Technology — Fish can sense the frequency, amplitude, and direction of incident sounds using their ears, which contain a bony body (the otolith) overlaying an array of $O(10^4)$ hair cells in a fluid-filled sac. The acoustically induced motion of the otolith relative to the surrounding fluid should generate flows that can be sensed by the hair cells. The otolith is typically an irregularly shaped body with a groove, the sulcus, where most of the hair cells are located. The acoustically induced flow for an otolith in a plane sound wave was modeled as a grooved spheroid oscillating sinusoidally at frequency f and amplitude s immersed in a viscous fluid. Experiments were performed at $Re = 2\pi f\, L^2/\nu \approx 10-200$ and normalized oscillation amplitudes $\varepsilon = s/L \approx 0.05 - 0.2$, where the spheroid length scale L is the product of the spheroid aspect ratio and its equivalent radius and ν is the fluid kinematic viscosity. Particle-image velocimetry and phase-locked pathline images of the steady streaming flow were obtained near the spheroid for grooves at different angular positions representing incident sound from different directions. More complicated sound fields were simulated by oscillating a spheroid at multiple frequencies along a single direction.

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