Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Groovy flow patterns in the fish ear[1] CHARLOTTE W. KOTAS, PETER H. ROGERS, MINAMI YODA, Georgia Institute of Technology — The dense, bony otoliths contained in the fish ear oscillate with respect to their surrounding tissue and endolymph in the presence of sound waves. How an otolith actually transduces this acoustically induced fluid motion into the hair cell displacements that the fish "hears" is not fully understood, however. The fluid flow created by the oscillation of the irregularly shaped otolith has both steady and unsteady components. Since most of the hair cells are next to a grooved area on the otolith, the sulcus, the otolith was modeled as a grooved spheroid oscillating in a quiescent Newtonian fluid. Particle-image velocimetry and pathline visualizations for the steady streaming flows within the groove are presented for oscillation at 0°–90° with respect to the body axis of symmetry $Re = 2\pi f L^2/\nu = O(10 - 10^2)$, and $\varepsilon = s/L \approx 0.025 - 0.05$. Here, ν is the fluid kinematic viscosity, L is a typical length based on the spheroid, and f and s are the oscillation frequency and amplitude, respectively. Results for bodies oscillated by multiple frequencies f_1 and f_2 along the same direction imply that the velocity fields are the superposition of those due to the component frequencies for small values of ε.

[1]Supported by ONR

Charlotte W. Kotas
Georgia Institute of Technology

Date submitted: 31 Jul 2007 Electronic form version 1.4