Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Hydrodynamic Forces On A Cylinder Vibrating Transversely And In-Line To A Steady Stream GEORGE TRIANTAFYLLOU, Department of Naval Architecture, National Technical University of Athens, Athens, Greece, LAMBROS KAIKTSIS, SOFIA PEPPA, Department of Naval Architecture, NTUA, Athens, Greece — We present computational results on the flow structure and forces in flow past a circular cylinder oscillating transversely and in-line to a uniform stream at Reynolds number 400. Three values of the transverse vibration frequency are implemented, corresponding to 1.0, 0.9 and 1.1 times the natural frequency of the Karman vortex street. The in-line vibration occurs at twice the frequency of the transverse oscillation. The cylinder thus follows an "eight"-like trajectory, emulating the trajectory of a free vortex-induced vibration. We find that the results of the simulation are greatly influenced by the direction in which the "eight" figure is traversed. We distinguish between a "counterclockwise" mode (if the upper part of the trajectory is traversed counterclockwise), and a "clockwise" mode (if the upper part of the trajectory is traversed clockwise). We find that the counterclockwise mode results in larger fluid forces than the clockwise mode for the same amplitude of oscillation. The power transfer from the fluid to the cylinder remains positive for the counterclockwise mode at higher values of the amplitude-over-diameter-ratio than it does either for the clockwise mode or for a transversely only vibrating cylinder.

George Triantafyllou
Department of Naval Architecture,
National Technical University of Athens, Athens, Greece

Date submitted: 11 Jul 2008 Electronic form version 1.4