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Hydrodynamics of a Contracting Cylinder in Translation[1] GORDON HOLLOWAY, University of New Brunswick, TIGER JEANS, USAFA Colorado Springs, ANDREW GERBER, SYDNEY RYAN, UNB — The present study examines the effects of body contraction on the hydrodynamics of a circular cylinder shortly after it is subjected to an impulsive start. Results for the development of the fluid vorticity, hydrodynamic impulse and drag were obtained using computational fluid dynamics and a transient re-meshing scheme that allowed accurate computation of the viscous layers in the vicinity of the cylinder surface. Computational results were obtained for Re = (Ua/ν) = 9500, and a constant cylinder diameter, up to t* = tU/a = 6; U is the cross flow velocity and "a" is the cylinder radius. In this case the drag force increased with time and exhibited undulations that were correlated with vortex shedding events. Computations for a contracting cylinder were initiated at t* = 3.6 using average contraction rates of r = (da/dt)/U = -0.38 and -0.50. These revealed a symmetric but very complex vortex shedding pattern. The drag force on the gradually contracting cylinder decreased initially and then oscillated about zero. For the more rapid contraction the cylinder experienced a strong thrust, due to the hydrodynamic impulse of the shed vorticity, before tapering off.

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