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Oscillatory Stokes Flow Past a Slip Cylinder[1] D. PALANIAPPAN, Texas A&M University - Corpus Christi — Two-dimensional transient slow viscous flow past a circular cylinder with Navier slip boundary conditions is considered in the limit of low-Reynolds number. The oscillatory Stokes flow problem around a cylinder is solved using the stream function method leading to an analytic solution in terms of modified Bessel functions of the second kind. The corresponding steady-state behavior yields the familiar paradoxical result first detected by Stokes. It is noted that the two *key* parameters, viz., the frequency λ, and the slip coefficient ξ have a significant impact on the flow field in the vicinity of the cylinder contour. In the limit of very low frequency, the flow is dominated by a term containing a well-known biharmonic function found by Stokes that has a singular behavior at infinity. Local streamlines for small times show interesting flow patterns. Attached eddies due to flow separation - observed in the no-slip case - either get detached or pushed away from the cylinder surface as ξ is varied. Computed asymptotic results predict that the flow exhibits inviscid behavior far away from the cylinder in the frequency range $0 < \lambda \ll 1$. Although the frequency of oscillations is finite, our exact solutions reveal fairly rapid transitions in the flow domain.

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