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Disturbed-Laminar Flow Over an Oscillating Cylinder

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The flow around a cylinder oscillating at small amplitude in fluid otherwise at rest is subject to instabilities that trigger first a regime of three-dimensional disturbed-laminar flow, and with increasing amplitudes of motion, turbulence. In the literature there are several accounts of both experimental and theoretical studies of this problem, which has relevance to the hydrodynamic damping of large floating offshore structures. However, there appears to be a conflict between analytical predictions and laboratory measurements relating to the onset of three-dimensional flow. Several researchers have reported damping levels to be about twice that predicted by Stokes' theory in conditions where no disturbances in the laminar flow are expected. This paper describes experiments aimed at resolving this difference, and describes measurements of hydrodynamic damping and visualisations of the flow. Attention is directed at the range $1,000 < \beta < 20,000$ where β is the Stokes parameter based on the cylinder's diameter.

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