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Hydrodynamic Force on a Cylinder Oscillating at Low Frequency

By -

BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 50 pages. Dimensions: 9.7in. x 7.4in. x 0.1in. The hydrodynamic force on a cylinder oscillating transversely to its axis is a nonlinear function of the displacement amplitude x_0 . We report measurements and numerical calculations of the force at frequencies low enough that δR , where δ is the viscous penetration length and R is the cylinder radius. For small amplitudes, the numerically calculated Fourier transform of the force per unit length, F_{small} , agrees with Stokes analytical calculation. For larger amplitudes, the force per unit length found by both calculation and measurement is $F F_{\text{small}} C(x_0 \delta, R \delta)$. The complex function C depends only weakly on $R \delta$, indicating that $x_0 \delta$ is more appropriate as a scaling variable than the Keulegan-Carpenter number $KC \pi x_0 R$. The measurements used a torsion oscillator driven at frequencies from 1 to 12 Hz while immersed in dense xenon. The oscillator comprised cylinders with an effective radius of R 13.4 micron and oscillation amplitudes as large as x_0 4 (corresponding to KC as large as 71). The calculations used similar conditions except that the amplitudes were as large as $x_0 \delta$ 28. This...


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