

Experimental investigation of coherent and turbulent fluid flow interactions with a circular cylinder

Abstract

This paper presents an experimental investigation of the surface pressure induced on a cylinder in laminar and turbulent flows. For the analysis of dynamic surface pressure and coherence, a highly instrumented cylinder with dynamic pressure transducers at various spanwise and peripheral locations was used. Surface pressure results for both laminar and turbulent incident flows show the emergence of the fundamental and its harmonics at most peripheral angles, while the first harmonic dominates the surface pressure spectra at the cylinder base. An increase in turbulence intensity also results in an increase in the energy level of unsteady pressure acting on the cylinder. The velocity-pressure coherence results also revealed the emergence of a strong coherence for both laminar and turbulent incident flows at the vortex shedding frequency, which was contributed by the vortex shedding energy field. Turbulence flow has also reduced, and to some extent eliminated, higher frequency coherence.