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Unsteady Properties of a Separated and Reattaching Flow SARAH BLACKMAR, RICHARD HILLIER, Imperial College London — Separated flows are commonly responsible for buffet on buildings, cars, and aircraft. The process of separation and reattachment that occurs in these instances is highly unsteady and turbulent, inducing large pressure fluctuations on the surface below. These unsteady effects are poorly understood and cannot be accurately predicted for many common practical problems. Low speed wind tunnel experiments ($\mathrm{Re} = 1\mathrm{x}10^5$ based on model diameter) have studied the unsteady properties of the separated and reattaching flow around a blunt-faced circular cylinder axially aligned with the freestream. The model was configurable with three different nose pieces: one flat front face, and two circular domed front faces, altogether providing three different flow separation angles. Extensive coverage of surface pressure fluctuation data provides detailed streamwise and spanwise distributions for mean and RMS pressure distributions, autospectra, streamwise and spanwise correlations, and cross-spectra. The separated shear layer is largely characterized by the low-frequency 'flapping' of the shear layer as a whole and the development of large-scale vortices within the shear layer. Correlations between surface pressure fluctuations and flow field velocity fluctuation are used to relate these shear layer vortex structures to the mechanism of pressure generation.

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