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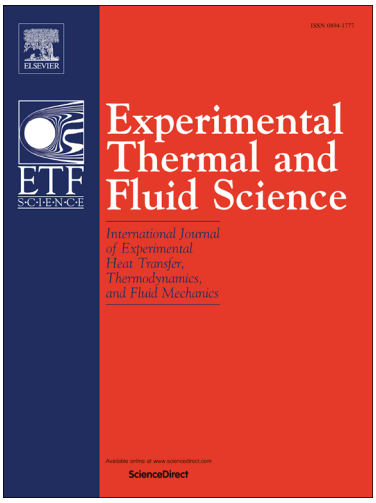

Flow around a Cube for Reynolds numbers between 500 and 55000

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Flow around a Cube for Reynolds numbers between 500 and 55000

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Abstract

The present work reports incompressible, viscous flow around a rigidly suspended stationary cube placed normal to the flow. The Reynolds number range covered in this work is more than two decades from Re $\in (500, 55000)$. Measurements are conducted using particle image velocimetry and dye visualization is undertaken for better understanding of the flow. The flow is seen to be structureless at higher Reynolds number. Mean and rms velocities at different axial locations in the wake are examined along with the mean vorticity field. Two peaks are observed in the U_{rms} profiles at different axial locations in the wake. V_{rms} is single peaked at lower Re and has weak double peaks at higher Re. Behaviour of centerline velocity of the wake gives an insight about the recirculation length and shows its non-dependence on Re. Wake size has been determined and trajectory of the maximum vorticity in the wake is discussed. Drag coefficients are evaluated and compared with various correlations for sphere and cube. The modified wake survey method gives coefficients of drag between 0.63 to 0.89, which are close to the values for a cube given by Hölzer and Sommerfeld (2008) within the experimented Reynolds number range. Using the recirculation length, the data shows a dependence on Reynolds number till Re $\sim$ 1200 beyond which it becomes independent of Re. Overall several similarities in the flow behaviour with respect to sphere is noted from the results. The paper is the first detailed study on a cube over such a wide range of Reynolds number.

Keywords: Cube, Wake, Drag coefficient, Particle Image Velocimetry (PIV)

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