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Study of Turbulence in Unsteady Flows using Particle Image Velocimetry (PIV) and Constant Temperature Anemometry (CTA) BENJAMIN OLUWADARE, AKSHAT MATHUR, SHUISHENG HE, The University of Sheffield, United Kingdom — Experimental studies are carried out to investigate transition to turbulence of a transient turbulent flows, a concept proposed by He & Seddighi (2013) based on DNS results. PIV is used in this study to measure instantaneous velocity of the unsteady flows. CTA is used to determine skin friction coefficient and wall shear stress. A pneumatically regulated valve is used to control the flowrate during the transient flows. The valve opening is controlled to produce pre-determined flow variations. Measurements of mean and turbulent statistics of the transient flows are obtained. Immediately after the flow excursion, skin friction coefficient increases sharply and reaches the maximum value. This reflects the creation of a thin boundary layer near the wall that results in an increase of velocity gradient and viscous force. As the boundary layer thickness increases, the viscous force decreases and the skin friction coefficient reduces. Later, the boundary layer becomes unstable resulting in a transition to turbulence. The minimum point of the friction coefficient marks the beginning of transition. The friction increases again during the transitional period. These observations conform the theories presented by Jacobs & Durbin (2001) and He & Seddighi (2015).

Benjamin Oluwadare
The University of Sheffield, United Kingdom

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