Experiments for characterising the influence of free stream turbulence length scales and intensity on boundary layer transition

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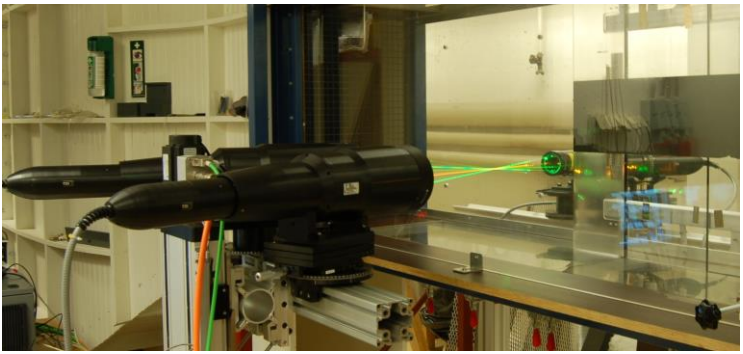
Boundary layer transition strongly depends on the length scales of free stream turbulence and the extent of its penetration into the boundary layer. The influence of both turbulence intensity and its characteristic length scales has been known since long, but many fundamental questions concerning this transition scenario are still unanswered. Within the experimental project, we will study the transition scenario from laminar to turbulent flow caused by free stream turbulence. This project is planned as a continuation of doctoral research work done by Shahab Shahinfar*. The aim of the project is to understand the influence of the integral length scale and turbulence intensity on the boundary layer receptivity of the free stream turbulence. The characterization of turbulence can be obtained from the measurements performed using optical, non-intrusive 3-component Laser Doppler Velocimetry systems which can handle measurements across complex geometries such as the leading edge. Also, the traditional Hotwire Anemometry will be employed in the measurements, which have a better frequency response than Laser Doppler Velocimetry systems especially at low speeds. Fully resolved Direct Numerical Simulations reveal that the spanwise scale of the boundary layer streaks do not vary with the free stream turbulence length scale, but, does it also hold for 'very' large length scales? In view of this fact, it is also necessary to provide an experimental evidence about the streak scale variation with free stream turbulence length scale.



*An experimental study on streamwise streaks in transitional boundary layers, PhD Thesis, *Shahab Shahinfar*, KTH Mechanics, Stockholm.

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