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Experiments for characterizing the influence of free-stream turbulence length scales and intensity on boundary layer transition - EXCALIBUR[1] SANTHOSH BABU MAMIDALA, ANDRE WEINGAERTNER, JENS FRANSSON, Linne flow centre, KTH Mechanics — Since the thirties of the last century, a significant number of studies have been performed on free-stream turbulence (FST) induced boundary layer transition. Despite this, the basic problem in modelling this transition scenario is the lack of physical understanding. The primary intent of the study is to understand the influence of FST conditions namely, the integral length scale and turbulence intensity (Tu) on the boundary layer receptivity of the FST (low to high levels as much as 7%). A new approach is investigated against the need to establish a transition detection method using electret sub-miniature microphones mounted in a cavity behind a pinhole on a flat plate. The current study relies on the information extracted from both single-point and two-point correlation measurements using hot-wire anemometers and a total of 300 microphones. Main results to be presented from this huge experimental campaign include data obtained at various free-stream velocities and initial FST conditions. The results show that, there is a clear dependence of FST conditions on the spanwise scale of elongated unsteady streamwise streaks. Further, a semi-empirical transition prediction model, that includes the effect of integral length scale and Tu will be presented.

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