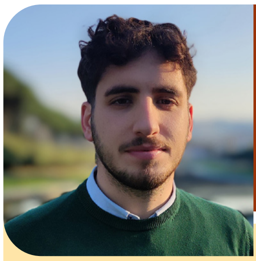

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ABSTRACT

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EXPERIMENTAL INVESTIGATION OF BOUNDARY LAYER TRANSITION THROUGH INFRARED THERMOGRAPHY

Laminar to turbulent transition is often detected as one of the main significant fluid dynamics phenomena, which estimation and control are vital for a robust aerodynamic design. The complexity of the transition mechanism, principally caused by unpredictable external factors that trigger instabilities (acoustic noise, free stream turbulence, non-uniformity of actual surface, etc.), determines the difficulty of its prediction and is responsible for the estimation uncertainty from the widely embraced computational tools.

A wide range of experimental techniques has been developed involving different principles: mechanical methods like oil flow visualization, electrical methods like hot film, and optical methods like particle image velocimetry and Infrared thermography (IRT). The latter had been largely explored due to its non-intrusive characteristics and embraced as a valuable instrument for thermos-fluid-dynamics investigations. Although they differ in many aspects depending on the specific application, IRT methods fundamentally exploit the idea that turbulent and laminar boundary layers have different heat transfer behaviour and that there is a close relationship between skin friction and heat flux at the wall. Quantitative IRT techniques have been developed and applied in different ways, depending on the external heat source used (necessary in subsonic flow due to low kinetic heating) like pre-heating the model or using continuous-pulsing source (internal electrical devices, heating sheets and heat lamp). The heat lamp technique with a portable infrared camera could be seen as a tool with high potential in industrial applications to detect transition on generic shape aerodynamic bodies due to its simplicity and portability.