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Three-dimensional characterization and control of Tollmien-Schlichting waves on a flat plate BURAK TUNA, MICHAEL AMITAY, Rensselaer Polytechnic Institute — Tollmien-Schlichting (T-S) waves are instability waves inside the boundary layer which are the prime mechanism for the transition from laminar to turbulent flows. The T-S waves grow in amplitude and develop three-dimensionality as they advect downstream. At sufficiently large amplitude they break up into turbulent spots, followed by a turbulent flow, which yields a drag increase. The present work aims to identify the T-S waves and reduce their amplitude to delay transition to turbulence. For that propose, Piezoelectric-Driven Oscillating Surface (PDOS) actuator was developed; Two PDOS actuators were used are two stream wise locations. The upstream PDOS was used to excite and phase-lock the T-S waves, and the downstream PDOS was used to cancel the T-S waves by applying an anti phase disturbance at the proper amplitude. Stereoscopic particle image velocimetry (SPIV) was used to identify the three-dimensional development of the T-S waves along the flat plate. Moreover, the SPIV results showed that reduction of peak values of velocity fluctuations due to the T-S waves could be achieved, and this reduction corresponds to a delay of laminar to turbulent transition.

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