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Tollmien-Schlichting wave cancellation by feedback control[1] HARI VEMURI, JONATHAN MORRISON, ERIC KERRIGAN, Imperial College London — Tollmien-Schlichting (TS) waves are primary instabilities in the boundary layer and, by actively interfering with their growth, the transition process can be delayed. In this study the experimental results of both open-loop and real-time feedback control will be shown for 3D TS waves excited within a flat-plate boundary layer. They are excited at a 0.75mm pin-hole source driven by a speaker. A 0.75 mm thin, dual slot geometry is used for actuation by another speaker and a wall hot-wire sensor manufactured in-house is used as the sensor for feedback control. The spatial transfer function models between the source and sensor (G_s) and the actuator and sensor (G_a) obtained by classic frequency sweep techniques are used to synthesize various types of robust, stabilizing controllers (K). The transfer function G_s determines the unstable range of frequencies whereas G_a together with K determines the stability of the closed-loop. A second traversing hot-wire is used to record the performance of the controller downstream. It is shown that the experimental transfer functions agree remarkably well with numerical calculations as do the predicted results from feedback control. Preliminary experimental feedback control results for various other actuator configurations will also be presented.

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