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**Reactive control of transition induced by free-stream turbulence: an experimental demonstration.** (English) Zbl 1118.76011

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Summary: The present wind-tunnel experiment demonstrates that a reactive control system is able to decrease the amplitude of random disturbances in a flat-plate boundary layer. The disturbances were induced in a laminar boundary layer by a turbulent free stream. The control system consisted of upstream wall-shear-stress sensors (wall wires) and downstream actuators (suction through holes). An ad hoc threshold-and-delay control algorithm is evaluated and parameter variations were performed in order to find a suitable working point of the control system. Detailed measurements of the flow field show how the control influences the disturbances in the boundary layer, whereas the effect on the mean flow owing to the control is minute. The control system manages to inhibit the growth of the fluctuations of the streamwise velocity component for a considerable distance downstream of the two actuator positions. Further downstream, however, the amplitudes of the fluctuations grow again. The flow rate used to obtain the control effect is one sixth of that necessary if continuous distributed suction is used to reach the same control objective. Finally, correlations and spectra show that the elongation of the structures in the streamwise direction is eliminated in the regions where the control has the largest effect. The spanwise scale of the disturbances is not affected by the control.

**MSC:**

[76-05](#) Experimental work for problems pertaining to fluid mechanics

[76F70](#) Control of turbulent flows

[76F06](#) Transition to turbulence

[76F40](#) Turbulent boundary layers

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**Keywords:**

flat-plate boundary layer; wall-shear-stress sensors

**Full Text:** [DOI](#)

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