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Control of Turbulent Streaks by Active Wall Movement

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Experimental results on the near-wall structures of turbulent boundary layers subject to a dynamic deformation of the wall are presented. The movement of the wall is based on computational evidence showing that a spanwise forcing in the form of a standing or travelling wave of the right amplitude, wave length and frequency can produce a significant turbulent drag reduction. This action is supposed to act on the near-wall coherent structures, whose dynamics controls the turbulence production. The control is first tested on a model of the near-wall turbulent boundary layer, streamwise vortices and streaks are produced artificially by an array of roughness elements in a Blasius boundary layer. The control in the form of a standing wave has been tested and work is in progress to appraise the effectiveness of a spanwise travelling wave. So far, it has been found that the most effective excitation wave has a period of oscillations close to 50 viscous units of time, in agreement with experimental and theoretical results on similar configurations. Future work will consider the effect of the actuation module in turbulent flows.

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