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Time-resolved PIV of a turbulent boundary layer over a spanwise-oscillating surface[1] KEVIN GOUDER, JONATHAN MORRISON, Imperial College — This work reports measurements of a turbulent boundary layer at $\mathrm{Re}_\theta \approx 2500$, over a resonant spanwise-oscillating surface driven by a linear electromagnetic motor. Time-resolved PIV measurements of velocity are presented and supplemented by hot-wire measurements of velocity and direct drag measurements of friction drag using a drag balance. A maximum of 16% surface friction reduction, as calculated by the diminution of the wall-normal streamwise velocity gradient was obtained. The PIV laser beam was parallel to the plane of the oscillating surface at a height of $y^+ \approx 15$, hence, top-down views of the near-wall turbulence activity and the effect of the surface oscillation on its evolution were obtained. It has been shown that the imposition of a spanwise Stokes-like layer at a non-dimensional period of $T^+ = Tu_\tau^2/\nu \approx 100$ at peak-peak oscillation amplitudes equal to or larger than the mean streak spacing enabled the direct manipulation of the quasi-streamwise near-wall structures and caused fundamental changes in their evolution leading to reductions, for example, in the near-wall values of the mean-square of the streamwise fluctuating velocity component.

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