

## Controlling boundary layer transition to turbulence with flexible wall panels

Turbulent flows are associated with large drag. Here we study via direct numerical simulation (DNS) how suitably designed compliant wall panels, interacting with the flow, may suppress the breakdown of wavepacket disturbances into turbulence. The transition distance from disturbance initiation to the formation of the turbulence spot is increased by  $\approx 50\%$  when a single panel is used. The transition distance could be further increased when a series of panels is used.

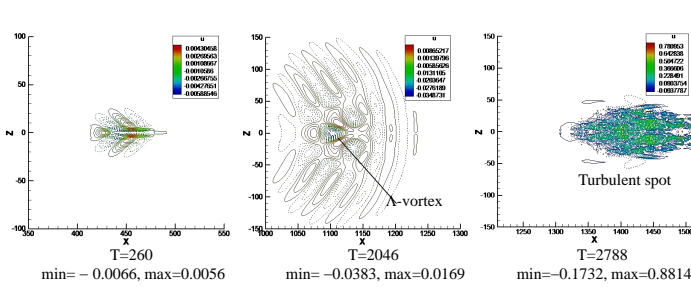


Figure 2: Contours of  $u$ -velocity over a rigid wall (no panel), showing breakdown into turbulence.

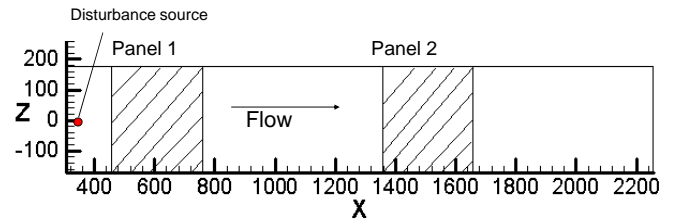


Figure 1: Schematics plan of computational domain.

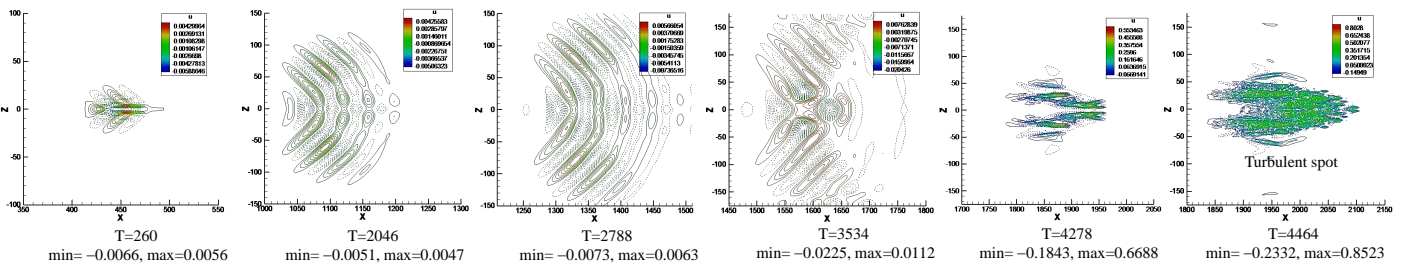


Figure 3: Contours of  $u$ -velocity over wall with panel 1. Turbulent spot forms further downstream due to slower disturbance growth.

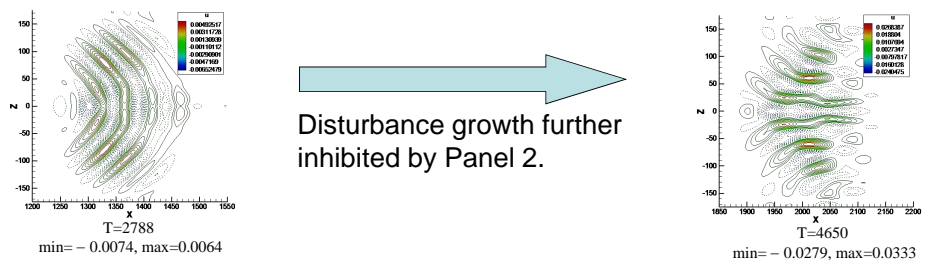


Figure 4: Contours of  $u$ -velocity for wall with 2 panels. No turbulent spot forms within the computational domain.

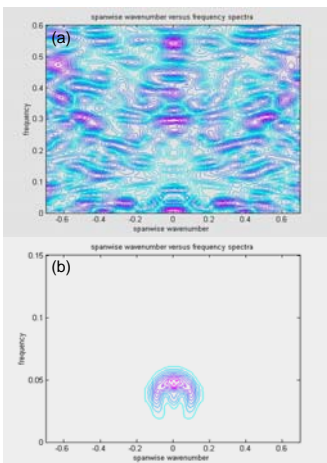


Figure 5: disturbance spectra at  $X=1380$ , (a) rigid wall (b) wall with one flexible panel.

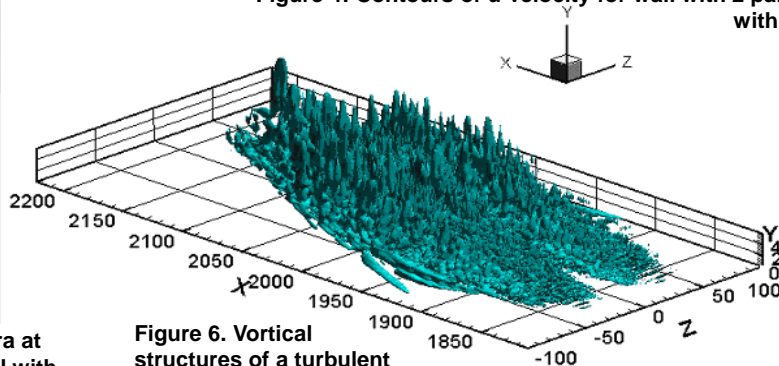


Figure 6. Vortical structures of a turbulent spot.