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Wall-bounded turbulence control using a Monte-Carlo approach[1]
OSCAR FLORES, ROBERTO PASTOR, Universidad Carlos III de Madrid, ALBERTO VELA-MARTIN, Universidad Politecnica de Madrid — Wall-bounded turbulence is very important in engineering applications involving fluids. Indeed, whenever flow control is sought in engineering applications both sensing and actuation are restricted to devices placed at solid walls. In the present work we tackle the classical problem of skin friction control in wall-bounded turbulence for the case of localised actuation using a Monte Carlo approach. To that end, DNS of a minimal channel of the buffer layer ($Re_\tau = 180$) are run using GPUs. The actuation is a volumetric vertical force applied close to the wall on a characteristic volume L^3 and with duration T. Several forcing are considered, with $L^+ = [50, 100]$ and $T^+ = [25, 50, 100]$. Their effect is evaluated for $O(10^4)$ episodes, directly comparing the instantaneous skin friction of forced and unforced simulations. The statistical analysis shows that drag increase and decrease are equally probable when the forcing is randomly applied. Episodes with drag decrease show a positive (negative) vertical force being applied to passing sweep (ejection) events, in agreement with opposition control strategies. Preliminary results also suggest that a skin friction sensor upstream of the forcing is a better trigger for the forcing than a wall-pressure sensor at the same location.

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