Abstract Submitted for the DFD19 Meeting of The American Physical Society

Drag-reduction curves for anisotropic permeable substrates¹ GARAZI GOMEZ-DE-SEGURA, RICARDO GARCIA-MAYORAL, University of Cambridge — We present DNSs of channel flows bounded by modelled streamwise-preferential permeable substrates. The resulting drag curves are similar to those of riblets. For small permeabilities, the curves exhibit a linear regime, where drag reduction is proportional to the difference between the streamwise and spanwise permeabilities. This breaks down for a critical value of the wall-normal permeability, beyond which spanwise-coherent, Kelvin-Helmholtz-like structures develop, and the performance begins to degrade. We present simple linearised models to predict both the linear regime and its breakdown, which yield accurate a priori estimates for the substrates' performance. The largest drag reduction observed in our DNSs is $\approx 20-25\%$ at a friction Reynolds number $Re_{\tau} = 180$, at least twice that obtained for riblets.

¹Engineering and Physical Sciences Research Council (EPSRC)

Garazi Gomez-De-Segura University of Cambridge

Date submitted: 01 Aug 2019 Electronic form version 1.4