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Stabilizing and destabilizing effects of finite-amplitude traveling waves in 2D and turbulent channel flows SUNG M. KANG, TAEGEE MIN, JASON L. SPEYER, JOHN KIM, University of California, Los Angeles — Our direct numerical simulations (DNS) have shown that skin-friction drag in a channel can be reduced substantially – in some cases, below that of a laminar flow – with blowing and suction at the wall applied in the form of an upstream traveling wave. The low skin-friction drag was due to the Reynolds shear stress associated with the periodic flow induced by the traveling wave. Floquet analysis of finite-amplitude traveling waves is used to investigate their effects on the stability of the channel flow. At both subcritical and supercritical Re, the predicted instability is consistent with DNS results when wave amplitudes are small. With larger wave amplitudes, the present Floquet analysis indicates unstable 2D disturbances, whereas DNS indicates the opposite.

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