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Control of transition in Poiseuille flow using streamwise traveling waves. Part 2: Direct numerical simulations[1] BINH LIEU, RASHAD MOARREF, MIHAILO R. JOVANOVIĆ, University of Minnesota — This work builds on and confirms the theoretical findings of Part 1 of this paper. We use direct numerical simulations (DNS) of the Navier-Stokes (NS) equations to assess the efficacy of blowing and suction in the form of streamwise traveling waves for transition control in Poiseuille flow. We highlight the effects of the modified base flow on the dynamics of velocity fluctuations and the net efficiency. Our simulations verify theoretical predictions of Part 1 that the upstream traveling waves promote turbulence even when the uncontrolled flow stays laminar. On the other hand, the downstream traveling waves with parameters selected in Part 1 are capable of reducing the fluctuations' kinetic energy and maintaining the laminar flow. For this choice of control, a positive net efficiency of 26 % compared to the turbulent uncontrolled flow can be achieved. The DNS results of this paper elucidate the predictive power of the method developed in Part 1 and suggest that the linearized NS equations with uncertainty may serve as an effective control-oriented model for preventing transition.

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