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Optimization of flow initialization and perturbation forcing for fast transition towards fully developed turbulent channel flow XIN WEN, CHENG PENG, LIAN-PING WANG, University of Delaware — The turbulent channel flow has been used as the simplest setup to study the flow structure and dynamics in wall-bounded single-phase and multiphase turbulence. An aspect that has not been well studied in direct numerical simulation of such flow is how to initiate such flow simulation and force the flow so that a fully developed turbulence can be achieved relatively quickly. Often it may take ~ 50 eddy turnover times (defined in terms of the channel half width and wall friction velocity) for the flow to evolve to a fully developed stage, due to different time scales involved in the wall region and the center of the channel and coupling of the flows between the two. In this talk, we explore different ways to initialize the flow and to excite the flow at the early stage. The initialization typically consists of a mean flow and a disturbance flow. The excitations could be done by adding external perturbation forcing. The parameters in the initial flow and the forcing affect the speed of transition to realistic fully developed turbulence. We will discuss how to control these parameters so that realistic flow structures, Reynolds stress and rms velocity profiles can be generated quickly while maintaining a nearly constant mean flow speed.

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