Peixinho, J.; **Mullin, T.**
Finite-amplitude thresholds for transition in pipe flow. (English) Zbl 1114.76304
J. Fluid Mech. 582, 169-178 (2007).

Summary: We report the results of an experimental study of the finite-amplitude thresholds for transition to turbulence in a constant mass flux pipe flow. The flow was perturbed using small impulsive jets and push-pull disturbances from holes in the pipe wall. The flux of the disturbance is used to define an amplitude for the perturbation and the critical value required to cause transition scales in proportion to Re^{-1} for jets. In this case, the transition is catastrophic and the scaling suggests a simple balance between inertia and viscosity. On the other hand, the threshold scales as $Re^{-1.3}$ or $Re^{-1.5}$ for push-pull disturbances with the precise value depending on the orientation of the perturbation. Further, the amplitudes required to cause transition are typically an order of magnitude smaller than for jets. When the push-pull perturbation was applied in the oblique direction, streaks and hairpin vortices appeared during the growth phase of the disturbance. The scaling of the threshold and the growth of structures are both consistent with ideas associated with temporary algebraic growth.

MSC:

76-05 Experimental work for problems pertaining to fluid mechanics
76F06 Transition to turbulence

Keywords:

push-pull perturbation; impulsive jets; scaling

Full Text: DOI