NEW EXPERIMENTS ON SUBCRITICAL TRANSITION TO TURBULENCE IN COUETTE-POISEUILLE FLOW

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We study the subcritical transition to turbulence in the plane Couette-Poiseuille shear flow with zero mean advection velocity. Our new experimental configuration consists on one moving wall of the test section (the second one remains stationary), which acts like a driving force for the flow, imposing linear streamwise velocity profile (Couette) and adverse pressure gradient in the streamwise direction (Poiseuille) at the same time. This flow, which had only been studied theoretically up to now, is always linearly stable. The transition to turbulence is forced by a very well controlled finite-size perturbation by injection, into the test section, of a water jet during a very short time. With fluid visualization we characterized the mains spatial patterns during transition, including spots and bands. Using PIV technique, we characterized quantitatively the initial development of the triggered turbulent spot and compared its energy evolution with the theoretical predictions of the transient growth theory. In addition, we show results concerning the importance of nonlinearities, when waviness of streaks in streamwise direction induced self-sustained process in the turbulent spot. We also measured precisely the large-scale flow which is generated around the turbulent spot and studied its strength as a function of the Reynolds number.