Eckhardt, Bruno; **Schneider, Tobias M.**; **Hof, Bjorn**; **Westerweel, Jerry**
Turbulence transition in pipe flow. (English) Zbl 1296.76062
Davis, Stephen H. (ed.) et al., Annual review of fluid mechanics. Vol. 39. Palo Alto, CA: Annual Reviews (ISBN 0-8243-0739-9/hbk). Annual Review of Fluid Mechanics 39, 447-468 (2007).

Summary: Pipe flow is a prominent example among the shear flows that undergo transition to turbulence without mediation by a linear instability of the laminar profile. Experiments on pipe flow, as well as plane Couette and plane Poiseuille flow, show that triggering turbulence depends sensitively on initial conditions, that between the laminar and the turbulent states there exists no intermediate state with simple spatial or temporal characteristics, and that turbulence is not persistent, i.e., it can decay again, if the observation time is long enough. All these features can consistently be explained on the assumption that the turbulent state corresponds to a chaotic saddle in state space. The goal of this review is to explain this concept, summarize the numerical and experimental evidence for pipe flow, and outline the consequences for related flows.

For the entire collection see [Zbl 1106.76006].

MSC:

76F06 Transition to turbulence
76-02 Research exposition (monographs, survey articles) pertaining to fluid mechanics

Keywords:

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