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Criterion of Turbulent Transition in Pressure Driven Flows HUA-SHU DOU, Zhejiang Sci-Tech University, BOO CHEONG KHOO, National University of Singapore — It has been found from numerical simulations and experiments that velocity inflection could result in turbulent transition in viscous parallel flows. However, there are exceptions, for example, in the plane Poiseuille-Couette flow. Thus, whether velocity inflection necessarily leads to turbulent transition is still not clear. To-date, there is still no consensus on the physics of turbulence transition in the scientific community. In this study, the mechanism of turbulent transition is investigated using the energy gradient method. It is found that the transition to turbulence from a laminar flow depends on the magnitudes of the energy gradient function and the energy of the disturbance imposed (including both the amplitude and the frequency). Our study further reveals that the criterion of turbulent transition is different in pressure and shear driven flows. In pressure driven parallel flows, it is found that the necessary and sufficient condition of turbulent transition is the existence of an inflection point on the velocity profile. This criterion is found to be consistent with the available experimental data and numerical simulation results. On contrast, velocity inflection in shear driven flows does not necessarily lead to turbulent transition.

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