

عنوان مقاله:

Stabilizing Pipe Flow by Flattening the Velocity Profile

محل انتشار:

دوماهنامه مکانیک سیالات کاربردی، دوره 17، شماره 11 (سال: 1403)

تعداد صفحات اصل مقاله: 10

نویسندگان:

C. Q. Zhou - Faculty of Mechanical Engineering, Zhejiang Sci-Tech University, Hangzhou, Zhejiang, ۳۱۰۰۱۸, China

H. L. Zhao - College of Aeronautics, Guizhou Vocational Technology Institute, Guiyang, Guizhou, ۵۵۰۰۲۳, China

H. S. Dou - Faculty of Mechanical Engineering, Zhejiang Sci-Tech University, Hangzhou, Zhejiang, ۳۱۰۰۱۸, China

خلاصه مقاله:

It is important to control turbulence in industrial processes. Past experimental and numerical researches have shown that a turbulent puff in pipe flow can be removed or delayed by flattening the profile of the upstream velocity because a flattened velocity profile causes the point of inflection on it to collapse. The energy gradient theory has been developed to study turbulent transition, and the relevant studies have shown that turbulence arises due to the generation of singularities in the flow field. In pressure-driven flows like the pipe flow, the point of inflection on the velocity profile leads to the appearance of a singular point in the unsteady Navier-Stokes equation. In this study, the energy gradient theory is used to demonstrate why the point of inflection on the profile of velocity of pipe flow is the critical point for generating turbulence. Then, it is shown how flattening the velocity profile leads to the elimination of the point of inflection on the velocity profile of pipe flows to delay turbulent transition. It is also clarified why this technique is not effective at higher Reynolds number because the flattened velocity profile violates the criterion for flow stability relating to transition to turbulence.

کلمات کلیدی:

pipe flow, Turbulent transition, Flattened velocity profile, Point of inflection, Energy gradient theory

لینک ثابت مقاله در پایگاه سیویلیکا:

<https://civilica.com/doc/2064162>

