[Proceeding] Perturbation enstrophy decay in Poiseuille and Couette flows according to Synge’s method

Original Citation:

Availability:
This version is available at: http://porto.polito.it/2657307/ since: November 2016

Publisher:
American Physical Society

Terms of use:
This article is made available under terms and conditions applicable to Open Access Policy Article ("Public - All rights reserved") , as described at http://porto.polito.it/terms_and_conditions.html

Porto, the institutional repository of the Politecnico di Torino, is provided by the University Library and the IT-Services. The aim is to enable open access to all the world. Please share with us how this access benefits you. Your story matters.

(Article begins on next page)
8:13 AM–8:26 AM

In this work we derive the conditions for no enstrophy growth for bidimensional perturbations in the plane Couette and Poiseuille flows. We follow the method of vorticity proposed by Synge in 1938 (see the Semi-Centennial Publication of the Amer. Math. Soc., equation 12.13, and the more detailed version in the Proc. of the Fifth Inter. Congress of Applied Mechanics, pages 326-332), which is actually based on the analysis of the spatially averaged enstrophy. We find that the limit curve in the perturbation wavenumber-Reynolds number map differs from the limit for no energy growth (see e.g. Reddy 1993). In particular, the absolute stability region for the enstrophy is wider than that of the kinetic energy, and the maximum Reynolds number giving the monotonic enstrophy decay, at all wavenumbers, is 155 and 80 for the Poiseuille and Couette flows, respectively. It should be noted that in past literature the energy-based analysis was preferred to Synge's enstrophy analysis. This, possibly, for two reasons: the low diffusivity of the 1938 Vth ICAM proceedings and the objectively very complicated analytical treatment required. Nevertheless, the potentiality of this method seems high and therefore it is interesting nowadays to exploit it by means of the symbolic calculus.

To cite this abstract, use the following reference: http://meetings.aps.org/link/BAPS.2015.DFD.G16.2