Transitional regime control in a fully developed channel flow

Transitional regime control in a fully developed channel flow

Gaetano Iuso [1], Raffaele Baggi [1], Davide Lasagna[2]
[1]*Department of Mechanical and Aerospace, Politecnico di Torino, Torino, Italy*
E-mail: *gaetano.iuso@polito.it*

[2]*University of Southampton, UK*
E-mail: lasagnadavide@gmail.com

Keywords: Flow control, transition delay, channel flow.

Abstract
Friction drag reduction is one of the main topic of investigation because of the great beneficial fallout in different engineering field. Laminar transition can be efficiently controlled using suitable flow control techniques [1]. Recent studies focused on the possibility of controlling transitional regimes in wall bounded flow have shown that the generation of streaks with appropriate intensity are able to control the transition in boundary layer. The concept of such control was shown by A1 et al. [2] using small cylinder mounted in the spanwise direction of a flat plate a zero incidence. These devices were able to generate streamwise vortices that in turn gave rise to streaks of well specific amplitude able to attenuate the transition. The paper will present results of an experimental investigation related to the transition control in a fully developed channel flow. For the streaks generation couples of convergent jets are positioned in the spanwise direction. In figure 1 the channel with the injection system are shown.

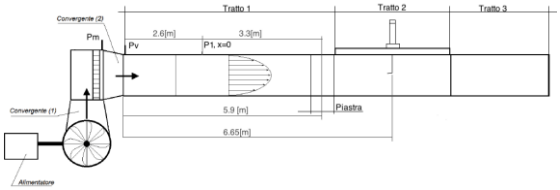
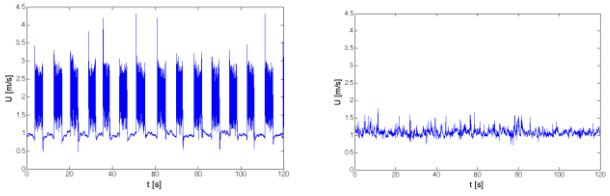


Figure 1. The channel

The effects of the jets mass flow rates in the transitional regimes of the channel have been investigated. It is highlighted the capability of the technique to delay or attenuate the transition in the channel. As an example of the results in figure 2 it is shown two time histories in condition of natural flow and controlled flow in the case of Reynolds number equal to and for a ratio velocity ($V_{jet}/V_{channel\ axis}$) equal to 0.47.



References

[1] Proceedings of European Drag Reduction and Flow Control Meeting – EDRFCM 2015, March 23–26, Cambridge, UK

[2] Fransson, J. H.M., Talamelli, A., Brandt, L. and Cossu, C. "Delaying transition to turbulenceby a passive mechanism" Phys. Rev. Lett. 96, 064501(2006).