LadHyX Seminar — March 6, 14:00

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Flow control for wall bounded and wake flows

The characterization of instabilities in spatially-developing open flows is a key result in fluid dynamics. A better understanding of the flow patterns and transition scenarios is, in fact, the basis to model their behaviour and to design novel and efficient controls. Moreover, the dramatic increase of the computational power that we are seeing in the last decades allows to investigate the stability properties of complex and tree-dimensional flow configurations.

In the first part of the talk, some examples of local and global stability analysis will be presented, highlighting (i) passive methods for transition delay in boundary layers, aimed at the reduction of the friction drag and (ii) the effect of the permeability on the transition scenarios of porous bluff bodies.

In the second part, weakly non-parallel flows are considered, where the WKBJ asymptotic analysis provides a rigorous strategy to link the local and global stability approach (Huerre & Monkewitz, Annual Review of Fluid Mechanics, Vol. 22 (1990)). We will see that, considering the physical optics level in the WKBJ approximation allows to provide accurate estimations of the global frequencies, reducing the error by about one order of magnitude than the geometrical optics approximation. The proposed approach is finally applied to analyze three-dimensional flow configurations, providing accurate estimations at highly reduced computational costs in comparison to the fully three-dimensional global stability analysis.