

Instabilities in detached boundary layer

Advisor: Prof. François Gallaire, LFMI, EPFL, Lausanne, Suisse.

Keywords: Detached flow, experiments

Strong turbulence in the recirculation regions in the wake of vehicles significantly contributes to the drag. In order to reduce this drag, it becomes necessary to control the development in space and time of these instabilities. In the prototype flow of a detached boundary layer flow over a bump, we have developed numerical methods to optimize the shape of the bump so as to prevent these instabilities. However, these predictions need to be confirmed experimentally.

The main goal of the project is to analyse, experimentally, the influence of the bump shape on the intensity of the unsteady fluctuations by testing various bump shapes in our windtunnel. PIV (particle image velocimetry) measurements yield a mean, time-averaged, velocity field, which allow the determination of the mean recirculation length as well as the friction and pressure distribution on the bump surface.

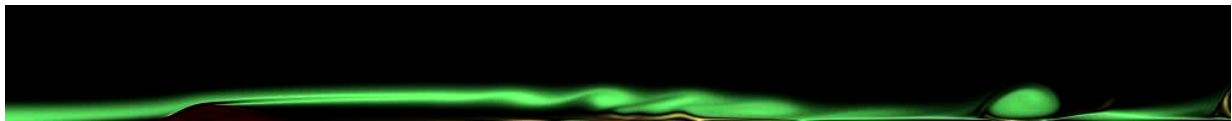


Fig. 1 Instantaneous vorticity field in the lee of a bump (Ehrenstein and Gallaire 2008)

In complement, hot-wire or LDA (Laser Doppler Anemometry) measurements will be conducted to construct pointwise time-series of the velocity and provide power spectra. The exact influence of the bump shape on the frequency content of the instabilities will thereby be determined and compared to our numerical predictions.

References:

Ehrenstein, U. & Gallaire, F. , Two-dimensional global low-frequency oscillations in a separating boundary-layer flow, *J. Fluid Mech.*, **614**, 2008, 315-327.