UNIVERSITÄT SIEGEN

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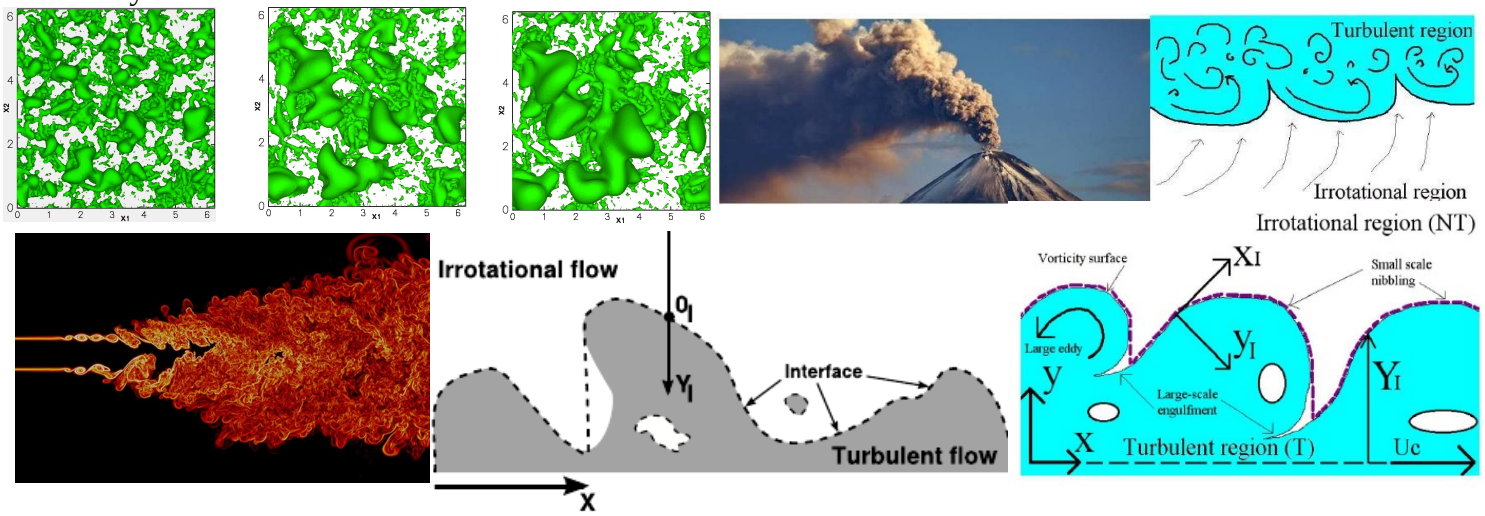
MASTERARBEIT

Jets and vibrating grid turbulence
Detection of turbulent/non-turbulent (TN/T) interface

Description of the problem :

Interfaces separating turbulent from non-turbulent fluid are ubiquitous in geophysical and industrial flows, e.g. at the edges of jets, plumes, mixing layers and wakes. These layers have always been known to be characteristic features of turbulent flows separating regions of high and low fluctuations of kinetic energy and at the same time and place regions of high and low concentration of other scalar and vector fields (see plots). Studies of such interfaces are helping to identify and answer some of the basic questions raised by these flows: how do boundary interfaces affect the large scale and mean properties of turbulent flows which are often characterized in terms of types of “entrainment” velocities? What roles do interfaces play in affecting the statistical-physical process in different types of turbulent flows, such as the mechanism, spread and transfer of energy between large- and small-scale eddy motions?



Tasks:

- Understanding of the theory of T/NT interface (defined as the separating surface between the irrotational and turbulent regions in free shear flows) and its detection;
  - preparation of the numerical code for detecting T/NT interface;
    - detection of T/NT interface in vibrating grid turbulence and jets using existing DNS data.
- MATLAB: Wavelet Toolbox™ - analysis, synthesis, denoising, and compression of signals and images.

Required qualifications:

- Basic knowledge in FORTAN and MATLAB;
- Basics of fluid dynamics.