Karlsruhe Institute of Technology

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Master thesis – numerical

Riblets behaviour in the drag-incresing regime

Background

Riblets are a peculiar, anisotropic surface roughness known for their ability to reduce friction compared to smooth surfaces when their size is small enough compared to turbulent structures. In recent years, though, such surfaces have gained scientific interest for their behaviour at larger viscous sizes, where they are expected to increase drag. Riblets were found to present a peculiar roughness function at large viscous sizes, as they appear to behave like a canonical rough surface for a certain size range, while they behave similarly to a smooth surface for even larger sizes. Moreover, in some cases, they were found to increase the heat transfer efficiency of the surface, as it happens in some case that the increase in heat transfer they provide is greater than the increase in drag they cause.

Content of the Thesis

An initial phase of the thesis may require the implementation of an innovative boundary condition to a direct numerical simulation (DNS) code designed to run on GPUs. The following part of the thesis involves the simulation of ribbed channel walls using the mentioned DNS code. The analysis of the results may focus on the friction behaviour as well as the heat transfer efficiency. Details may be discussed at a later stage.

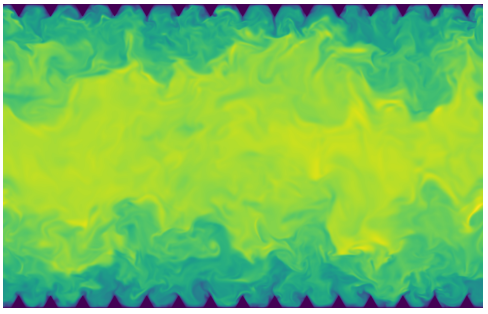

Figure 1: Snapshot of an instantaneous velocity field of a ribbed channel flow at $Re_\tau \approx 800$.

Beneficial Skills

Basic knowledge of turbulence,
Numerical fluid mechanics,
Python, Bash

Start: flexible

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