Karlsruhe Institute of Technology

Institute of Fluid Mechanics
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bachelor thesis – numerical

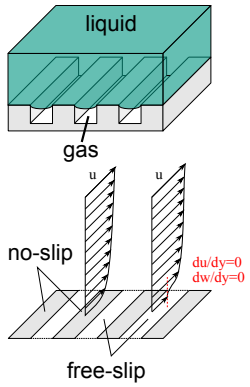
Secodary Motions Over Superhydrophobic Surfaces

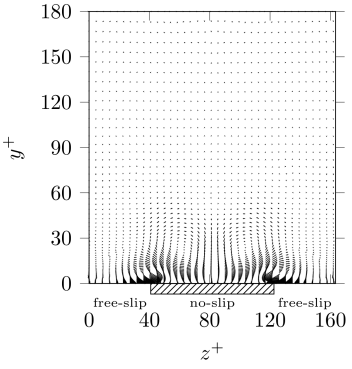
Background

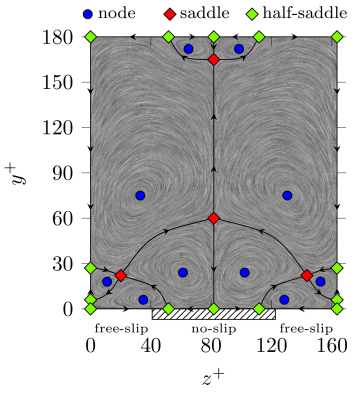
Superhydrophobic surfaces (SHS) are known to be able to introduce drag reduction effect in fully developed turbulent channel flow due to the presence of airpockets in the grooves of SHS. Also, the introduced spanwise heterogeneity of streamwise drag leads to the formation of large secondary motions of Prandtl's second kind which also strongly affects the mean velocity distribution, friction factor and heat transfer coefficient. However, the underlying mechanism of the secondary vortex formation is not yet entirely clear.

Content of the Thesis

An investigation of secondary motions induced by SHS has to be carried out with the available implementation utilizing direct numerical simulation (DNS), where SHS are introduced as no-slip/slip surface at the channel wall. A parametric study with variation of the SHS wavelength has to be carried out to generate time-resolved database of the flow field. Evaluation and analysis of flow topology for time-averaged and instantaneous velocity fields have to be performed on the generated data-sets. Statistical analysis of flow topology includes application of critical point analysis and proper orthogonal decomposition (POD) technique. The final aim of the thesis is to link the instantaneous topology of the flow to the secondary motions in order to clarify secondary motion formation mechanism.







Requirements

basic knowledge in fluid dynamics

Beneficial skills

CFD, Linux, Fortran, Matlab

You will learn

methods of scientific research, Matlab, HPC

Start: immediately

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