Karlsruher Institut für Technologie

Lehrstuhl und Institut für Strömungslehre

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Diplomarbeit/Master Thesis

Flow over superhydrophobic surfaces

Hydrophobic surfaces and their outstanding property to reduce wetting and to enable self-cleaning of a solid have become popular due to the successful bionic approach mimicing the lotus leaf. This principal is also used for the design of superhydrophobic surfaces which show appealing features in the context of skin friction drag reduction. These surfaces usually consist of a thin-film hydrophobic coating with a certain roughness pattern. Gas bubbles are trapped in the cavities of the roughness pattern, locally providing a gas-liquid interface with almost zero shear instead of the usual no-slip interface along a solid wall. This specific feature provides the possibility to reduce the flow resistance which is generated at a liquid-solid interface and thus the related energy consumption.

The **first part** of the Master Thesis deals with the **numerical prediction** of this flow situation in the turbulent regime. In previous studies direct numerical simulations (DNS) were performed that are rather time consuming (high computational costs) and restricted to relatively small turbulent Reynolds-numbers. It was noticed, that the observed drag reducing effect should in principle be possible to capture with appropriate turbulence models. Therefore, the capability of different turbulence models to predict the flow field over superhydrophobic surfaces is to be investigated using OpenFOAM. The most suitable turbulence model will be used for additional flow field predictions at higher Reynolds-numbers which are commonly found in technical applications.

The **second part** of the Thesis deals with the **design of an experimental facility** for investigation of the flow over superhydrophobic surfaces. The facility should allow determining the pressure drop of a channel flow with different surface properties. Hydrophobic surfaces can be produced at the Institute of Microstructure Technology at KIT and the existing fabrication restrictions are to be considered in the design process. The experimental facility will be used for the verification and validation of numerically obtained results and should therefore cover the laminar and turbulent regime over a rather broad Reynolds number range.

Requirements:	Experience in OpenFOAM is beneficial Interest in constructive work
Beginning:	Winter Semester 2012/2013
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