Karlsruhe Institute of Technology

Institute of Fluid Mechanics

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Bachelor thesis – experimental

Design, construction and testing of an orifice flow meter

Background

Flow control is a broad and active research field in fluid mechanics which investigates how the natural behaviour of flows can be favourably modified in view of particular technological goals. Flow control aimed at reducing the drag due to skin-friction is a very enticing field, thanks to the large potential economical savings for the transport industry. While these envisaged applications involve high Reynolds number (Re) flows, drag-reducing technologies can be mostly tested in laboratories at very low Re, at which experiments are more practical. However, the present evidence shows that the performance of such techniques decreases for increasing Re, so that the viability of flow control at Re typical of applications is a big question mark. In our institute a newly-built channel flow facility has been successfully exploited to perform accurate friction drag measurement. So far, measurements were limited to Reynolds numbers up to $Re_b = 25000$, while the facility is now capable to reach much higher Re_b of about 80000.

Content of the Thesis

This project aims at designing and constructing a new orifice flow meter device suitable for the upper range of Reynolds number, which can be achieved by the present wind-tunnel facility. Particular focus is posed in the design phase with the aim of minimizing the foreseeable measurements uncertainties. The flow rate, friction and skin-friction coefficients are then measured over the complete achievable Reynolds number range with all available flow meter devices, so as to provide useful high-quality reference data for any future measurement performed in the tunnel, wether it be with some drag-reducing device or drag-increasing rough surface.

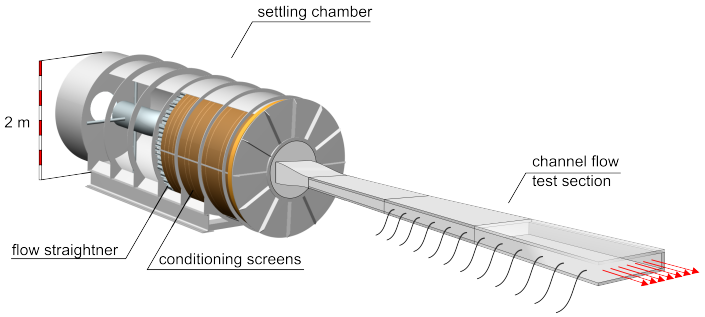

Abb.: Sketch of the wind tunnel.

Requirements

basic knowledge in fluid mechanics

Start: 1.6.2017

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