Masterarbeit

Numerical Investigations (2D) of the Flow past a Circular Cylinder with URANS

Aufgabenstellung:
The flow past a circular cylinder has been one of the most favourite subjects of experimental investigations during the last century. More recently, the numerical simulation of such flows has drawn the interest of many researchers. It has been shown that the correct prediction of the point of flow separation, of the shedding frequency, and of the drag coefficient is very challenging and requires some scale-resolving method like large eddy simulation (LES) or direct numerical simulation (DNS). These methods are very expensive because the computational domain needs to be finely resolved to capture even the small-scale turbulent structures. Recent developments in turbulence modelling yield promising models to be applied as turbulence closure to the unsteady Reynolds-averaged Navier-Stokes (URANS) equations, e.g. the shear stress transport (SST) turbulence model by Menter (1994) [1] and a modified k-ε model by Younis (2006) [2]. URANS simulations allow for a coarser grid spacing and a larger time step, which make it a valuable tool for parameter studies and large engineering problems. URANS has been widely applied in the past and showed good results for many flow problems, even though the turbulent structures are not resolved.

The prediction of the flow past a circular cylinder is one of the most challenging flow problems in numerical simulations. The aim of this work is to apply URANS with two different promising turbulence models within a Reynolds number range of $10^4 < Re < 10^7$. To validate the results and to show the limits of turbulence modelling the candidate can refer to a huge data base in literature.

![Pressure field in the wake of a circular cylinder taken from Younis (2006) [2]](chart)


Arbeitsschritte
- Acquire knowledge of the needed software (ANSYS ICEM, ANSYS CFX, MATLAB)
- Acquire knowledge of the relevant flow physics (flow past a circular cylinder, URANS simulation, turbulence modelling)
- Literature research
- Implementing the modified $k$-$\varepsilon$ turbulence model by Younis (2006) [2] in CFX
- Preparation of the numerical setups for different Reynolds numbers
- Evaluation of the numerical results: impact of the turbulence model and comparison with experimental results from literature
- Documentation of the results (English preferred)

Ort und Dauer
Die Bachelorarbeit wird am ITLR angefertigt und ist innerhalb eines Zeitraums von 6 Monaten abzuschließen.

Betreuung
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Ausgabe: 07.11.2018