Chair of Structural Analysis
Deparment of Civil, Geo and Environmental Engineering
Technical University of Munich

Validation of Reynolds Averaged Navier-Stokes in FEM

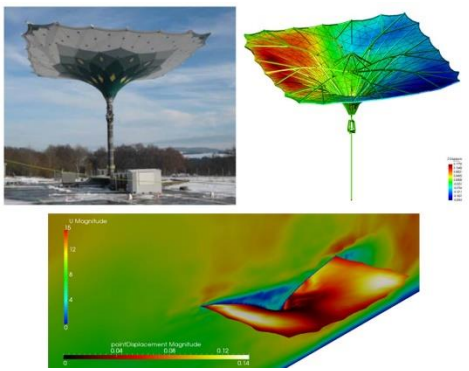
Project Characteristics

Modeling:	★★★★☆
Mathematics:	★★★★☆
Programming:	★★★☆☆
Science:	★★★☆☆

Setting:

Turbulent flows are a common phenomenon in everyone's life. Since turbulence involves motions at a range of length and time scales, a detailed prediction of turbulent flow would incur a prohibi-tively high computational cost. To avoid this issue, different mod-els have been developed to predict turbulent motion at a reduced cost. The Reynolds Averaged Navier-Stokes (RANS) equations define a family of such models, which are frequently used in in-dustry when an accurate prediction of averaged flow properties is sought. While there is considerable experience of RANS models in finite differences or finite volumes, their use in combination with the finite element method (FEM) remains comparatively rare. The open-source FEM framework Kratos Multiphysics will be used to develop a RANS solver, building on existing Computational Fluid Dynamics (CFD) capabilities of the code. Emphasis will be made on the validation of the developed strategies.

A few different turbulent flow models will be investigated in this project such as k-epsilon, k-omega and k-omega SST.



Tasks:

- • Implementing RANS models within an existing open-source finite element code.
- • Selecting and simulating benchmark cases to validate the implemented methods.
- • Critically assessing the developed code in terms of accuracy and performance.
- • Using the results of the validation to choose between different alternative formulations in terms of choice of model or boundary conditions, finite element mesh quality requirements or other relevant criteria.
- • Document the results of the investigation in order to establish best practices for the application of the models to new problems.