Software applications for high performance wind farm flow simulations

Roko Topic

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For this project, a test case was constructed using the OpenFOAM (OF) v2412 framework. The simulation involves a simple two-dimensional diffuser, set up using an externally provided mesh file. Four individual subcases, each using a different RANS turbulence model, were simulated until reasonable convergence was achieved. Vertical profiles of mean and high-order flow statistics are inspected at different positions in the diffuser. Wall adjacent parameters such as skin friction coefficient and pressure recovery are also observed at both upper and lower wall. Additionally, captured separation bubble, defined as the position where streamwise velocity crosses zero, is plotted and compared to experimental data.

Simulations are automatically performed with Allrun and Allclean shell scripts which perform all necessary OF functionalities and source the OF version when set accordingly with local file hierarchy. One sample case named "common" is placed in the main directory from which Allrun script creates 4 different subcases (kOmegaSST, SpalartAllmaras, kEpsilonPhitF and LaunderSharmaKE). The postprocessing script generates figures in a newly created Figures folder. Allclean script removes all newly created subcases and log files.

The project has been created on a remote computer and has later been added to a git repository: https://github.com/Rokotop/DiffuserCase.

Because of this, only the latest commits are documented. In the repository a CONDAenv.yml file is present which can be used to activate a conda environment necessary for running the postprocessing script (which is included in Allrun).

Lastly, a Test script is added to do a regression test. It compares the results of user modified Diffuser test case to the reference output values of different OF functionalities, mainly mesh validity and parameter convergence. It has to be run manually. To run the test case **OF v2412** has to be locally configured (instructions in the README.md file) and **sourced** manually or through Allrun and Allclean scripts.

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