Software Lab: Development of the 3D Finite Difference Code for the decaying turbulence

Supervisor: Prof. Dr.-Ing. Nikolai Kornev

The aim of the work is the development of a simple code based on the finite difference method for the three- dimensional case with periodic conditions in all three directions.

0.1 Work description. Steps

The flow is three dimensional in a computational box $[0, X] \times [0, X] \times [0, X]$. The periodic conditions are enforced in all three directions.

Use uniform Cartesian staggered grids. All formulas you can find in [1].

Use first only the semi- implicit method described on page 58 in [1].

0.1.1 Step 1

- Learn and install the Poisson equation solver FishPak.

0.1.2 Step 2

- Understand the theory and the code given by supervisor till the viscosity term treatment.

0.1.3 Step 3

- Understand the viscosity term and pressure term treatments.

0.1.4 Step 4

- Replace Poisson solver FPS3H from IMSL library through FishPak.

0.1.5 Step 5

- Run validation tests.

0.1.6 Step 6

- Implement the QUICK scheme for convection and pressure terms.

0.1.7 Step 7

- Run validation tests.

0.1.8 Step 8

- Implement the initial condition generation on the base of Sina Samarbakhsh C++ code.

0.1.9 Step 9

- Run validation tests.

0.2 Report

The possible content of the report is

- Introduction. Motivation of the work, aims.

- Theoretical background. Governing equations.

- Numerical Methods.

- Results. Analysis of graphs.

- Conclusion

- References.

The report in hard copy form should be submitted at least one week before the defending.

References

[1] Kornev N. & Cherunova I. (2014). Lectures on computational fluid dynamics and heat Transfer with applications to human thermodynamics. Bookboon Publisher.