Chair for Computation in Engineering
Chair of Computational Modeling and Simulation

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

Software Lab 2016:

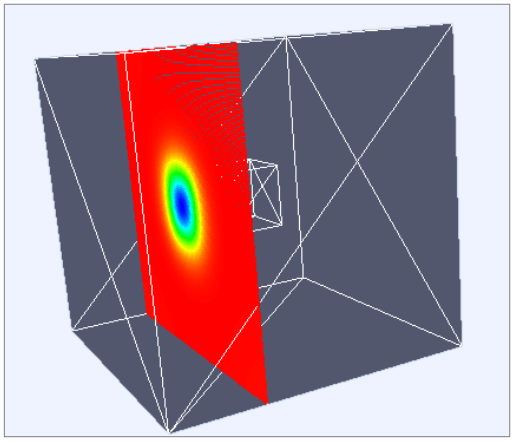
HPC Fluid Flow Simulations: Interactive Cross-Section Visualisation

Setting

A massive parallel CFD Framework, capable of performing diverse advanced scientific calculations in the field of computational fluid dynamics and interactive visualisation of obtained results will be the basis for this Software Lab Project. One major problem in the field of HPC simulations is the massive amount of data generated. In order to analyse this data in real-time, an online visualisation scheme that selects and retrieves data subsets during a running simulation is developed within the framework. This scheme consists of two components: A plugin for the visualisation front-end Paraview, which allows the user to submit a visualisation query, and a back-end collector process that selects and retrieves adequate requested data. A primary aim of this Software Lab is to extend the usability of this tool by implementing an interactive cross-section selection process (e.g. see figure below) on the front-end and an appropriate extension of the back-end collector process. This will enable a user to explore obtained data interactively, relocating the visualisation slice onto the particular part of the domain, which contains relevant information for some specific analyses.

The Software Lab will include all following tasks:

- Getting familiar with the basics of a massive parallel CFD code and the visualisation front-end Paraview
- Extending the codes online visualisation plugin by allowing the user to select and request a slice visualisation from the running simulation
- Implementing a suitable data selection procedure on the simulation back-end to retrieve the slice data
- Testing an implemented functionality on a chosen engineering application.



Both Sliding Slice function and the Paraview plugin are meant to be an extension to already existing visualisation techniques. The knowledge of C++ object oriented language is necessary both to understand the written code as well as to implement new features required.

Supervisors

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References

[1] Paraview Open Source Documentation – http://www.paraview.org/Wiki/ParaView/Custom_Filters

[2] Jerome Frisch, Towards Massive Parallel Fluid Flow Simulations in Computational Engineering, *Doctoral Thesis*, 30 September 2014.