H L R S

Master's thesis

Programming of an input routine in ParaView for the new coherent grid and field data format in OpenFOAM

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Introduction

OpenFOAM is a parallelised simulation code that originally creates a folder storing the simulation data per MPI process and time step. This results in a large number of files for transient simulation of highly parallel runs. In order to reduce the number of files, the new coherent grid and field data format was developed and implemented by the project partners HLRS and Wikki GmbH in the exaFOAM project (https://exafoam.eu).

Objectives and tasks

The coherent grid format uses a global, decomposable grid representation by reordering the owner/neighbour cell graph data. The new mesh representation is agnostic to a case's level of parallelism and always yields the same number of files. In detail, the coherent data format writes a small set of ASCII files for the metadata needed to manage the data structure and constraints. In addition, the co-located field values are stored as binary data in a large file via ADIOS2 (https://adios2.readthedocs.io). This reorganisation of the mesh structure and field data also offers further advantages, which are still the subject of ongoing work. The thesis aims to create a reading module as a plug-in for the ParaView visualisation application, with which the grid and field data can be read, processed, and visualised. The reader module should be able to read the data serially in the first step and then in parallel via a server/client approach. In detail, the following steps need to be carried out:

Steps

- Creation of a plug-in for ParaView to serially read a coherent grid
- Extension of the plug-in for serial reading of field data
- Extension of the plug-in for parallel reading of the coherent grid format
- Extension of the plug-in for parallel reading of field data
- Validation of the individual implementation steps and code documentation using git and Doxygen

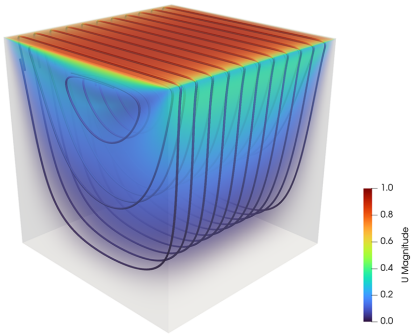

Figure: ParaView visualisation of a 3d cavity benchmark case

Requirements

- Logical thinking
- Programming experience
- Experience in debugging
- Curious about new ideas
- Havin fun trying things out

Knowledge gain

- Experience with ParaView
- Experience with I/O
- Strengthening C++ knowledge
- Proper code documentation
- Use of HPC resources

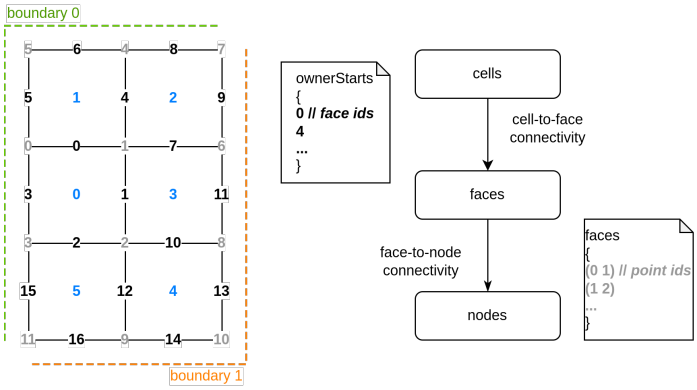

Figure: Example of a 2d coherent mesh layout with connectivity pattern