What is Fluidity

Fluidity is an open source, multi-phase Computational Fluid Dynamics (CFD) package solving the Navier-Stokes and accompanying field equations on arbitrary unstructured finite element mesh. This guide provides instructions on how to run a Fluidity test case on the HPC Wales systems.

Step 1 - Log in

The example used in this guide is configured to run on the Swansea Sandy Bridge cluster. Connect to *login.hpcwales.co.uk* with your HPC Wales user credentials using your preferred method (e.g. PuTTY from a Windows machine or ssh from any Linux terminal), then **`ssh sw-sb-log-001`** to connect to the Swansea system.

The steps below involve typing commands (**`in bold font`**) in the terminal window.

Step 2 - Load a Fluidity module

A number of Fluidity binary packages are available. Note that unlike most other software packages on the system, these are built with the GNU compiler.

- List pre-installed Fluidity versions:
  `module avail fluidity`
- Load your preferred version (4.1.11 is used in this tutorial):
  `module load fluidity/4.1.11`
- Confirm the loaded modules. Fluidity is a complex package depending on many other libraries, fortunately such dependencies are handled automatically via the modulefile:
  `module list`

Step 3 - Create a directory

Create a directory to hold any user data files. For this example, create a directory called OpenFOAM under your home directory:

```
cd ~
mkdir fluidity
```

Step 4 - Obtain a test case

A test case is provided with the installation at

```
/app/environment/fluidity/4.1.11/gnu-4.6.2/intel-4.0/example
```


Ewrop & Chymru:
Buddsoddi yn eich dyfodol
Cronfa Datblygu Rhanbarthol Ewrop
Europe & Wales:
Investing in your future
European Regional Development Fund
ERDF
Llywodraeth Cymru
Welsh Government

This directory contains all required Fluidity files, as well as a jobscript. Copy the jobscript to your user space:

```
cd ~/fluidity
cp /app/environment/fluidity/4.1.11/gnu-4.6.2/intel-4.0/example/runFluidityChannelWindDragParallel.q .
```

There is no need to copy the case files as they are transferred automatically when the job is submitted (see the `cp` command in the jobscript). Examine the *channel_wind_drag_parallel* directory containing the case files, in particular those .flml files that set up the simulations.

Step 5 - Submit a parallel job

Now you are ready to run this test case with the supplied jobscript *runFluidityChannelWindDragParallel.q*

- From your working directory, submit the job using:
  `bsub < runFluidityChannelWindDragParallel.q`
- Check the job queue using: `bjobs`
- The job should complete within a minute if it is not held in a queue. When completed, a directory called *channel_wind_drag_parallel* is created and many files generated.
- If the case runs successfully, the error files *fluidity.err-** should be empty and the log files *fluidity-log-** should contain all the screen output. Inspect the log files for more information

Step 6 – More test cases

More test cases are distributed with Fluidity. They can be found at

```
/app/SOURCES/environment/fluidity-4.1.11/examples
```

Adapt the jobscript above to run these cases.

To create a new case, refer to Chapter 8 of the Fluidity Manual, which is widely available online. An offline copy is at:

```
/app/environment/fluidity/4.1.11/gnu-4.6.2/intel-4.0/fluidity-manual-4.1.11.pdf
```

Note that a Graphics User Interface called Diamond may be used to set up new Fluidity simulations. However Diamond is not currently available on the HPC Wales system

References

Official Fluidity website: http://fluidityproject.github.io/