PhD Project

A Data Management Plan created using DMPonline

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Template: University of Manchester Generic Template

Project abstract:

The forthcoming generation of nuclear reactors, proposed Small Modular Reactor (SMR) designs make increased claims on passive safety features such as reliance upon natural circulation within the primary circuit as either an alternate, backup or main cooling approach following reactor trip or a fault occurring. The PhD project overviews the challenges concerned with the numerical modelling of the circuit behavior related to an SMR. A better understanding of the fluid flow and heat transfer characteristics is provided through the investigation of simplified systems, closed loops, in single phase and conditions that will be representative enough to draw a direct analogy with the reactors circuit and assess currently used one dimensional approaches. For the purpose, the Finite Volume method is adopted in order to characterize the flow field using the most widely verified turbulence models to close the Reynolds-averaged Navier-Stokes (RANS) equations. Implementing these models appropriately can enable the accurate prediction of the turbulence and the heat fluxes statistics of the flow field. The tool for the solution process is the opensource software Code_Saturne, a generic-purpose Computational Fluid Dynamics (CFD) code developed by EDF R&D. Academic canonical cases that DNS validation data is available such as an unsteady natural convection flow in a heated square cavity at sufficiently high Rayleigh number, (1e11), are initially investigated both using two dimensional and three dimensional grids. In this case, some of the turbulence models are challenged in maintaining the flow fully turbulent whereas others exhibit their performance in computing near wall heat fluxes with the log-law or a more advanced wall function treatment implemented. From the findings, the most suitable RANS models are identified to be used for simulating the more complex but geometrically simple natural circulation 3D loops on a range of Rayleigh numbers (1e9-1e11). This will assist in a more accurate 3D representation of the temperature and velocity distribution, giving a better insight in the design of any future experiments.

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PhD Project

Manchester Data Management Outline

- None of the above
- No - only institution involved
- Generate textual supporting information only
- P Drive (postgraduate researchers and students only)
- 1 - 8 TB
- No
- 0-4 years
- No sensitive or personal data

N/A

- Not applicable
- Not applicable
- Not applicable
- No

Prof Hector Iacovides

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Project details

The aim of the project is to investigate natural convection systems, academic canonical cases, which can assist in the safety and design of forthcoming power plants.

This is fundamental data which is not subject of any confitentiality and it has only scientific importance

Responsibilities and Resources

PI will be responsible

Access to the HPC and Research Data Storage

Data Collection

Numerical simulation results

Generated from computer simulation

Documentation and Metadata

PhD thesis and scientific publication will be the final outcome

Ethics and Legal Compliance

Not applicable

Not applicable

Storage and backup

Data will be stored both on local machine and central University Storage

Data is not confidential though access is given to specific users

Selection and Preservation

Contains amount of post process data that might be used for later associate projects/investigations

The PhD thesis will document the mehtodology of the generated data. We will compact the data that is most significant and the rest will be deleted after the end of the project.

Data Sharing

Information from the post process data will be made publically available

Not applicable