Project FORTE - Nuclear Thermal Hydraulics R&D for BEIS

Nuclear Thermal Hydraulics Modelling Specification

BENEFITS - Improving the design, efficiency and reliability of nuclear plant

Funded by BEIS through the Nuclear Innovation Programme, this work focuses on the specifics of what modelling capability is needed by the end users/developers, thus providing the most effective targeting for investment in development work. As this originates from the developers of future nuclear power, this provides direct routes for state of the art thermal hydraulics modelling to improve the efficiency and reliability of nuclear plant now and in the future.

THE CHALLENGE - Skills and capability development in an area fundamental to reactor design

Thermal hydraulics is key to the overall system integration and design of reactor plants and it is important to build this capability now to position the UK to take advantage of nuclear new build, SMR deployment and Gen-IV reactor development. Pre-existing nuclear thermal hydraulics modelling capability in the UK is strong, but requires further planning, development and integration to ensure this capability is central to the design and qualification of nuclear thermal hydraulics in the future.

OUR SOLUTION - Define, Understand and Develop State of the Art

The vision is to develop an integrated modelling and experimental capability in nuclear thermal hydraulics across industry and academia to enable the UK to be a significant partner in the global deployment of current and advanced reactor technologies. To accomplish this, Frazer-Nash Consultancy has formed and led a team of partners (The University of Manchester, The University of Sheffield, Westinghouse, EDF Energy and the Science and Technology Facilities Council).

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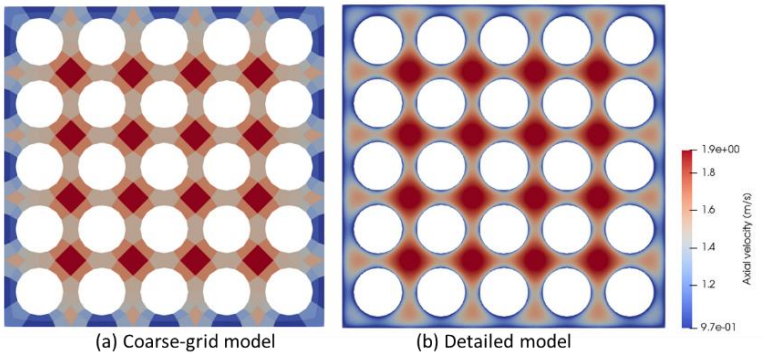
MANCHESTER 1824 The University of Manchester · The University Of Sheffield. · Science & Technology Facilities Council · EDF ENERGY · Westinghouse

The modelling project is ongoing with the technical approach summarised as:

- A critical review of the state-of-the-art in thermal hydraulic prediction capability.
- Review of user requirements for modelling capability. This highlighted the need for:
  - Quantification of uncertainty in CFD to increase ‘trust’ in advanced thermal hydraulic models;
  - High quality validation data to support model development and reactor design activities;
  - Innovative combination of modelling tools and techniques for quicker and more complete physical analysis;
  - Improvements in the understanding and simulation of four thermal hydraulic phenomena: natural convection, two-phase flow, single phase turbulent mixing, and fluid flow driven component fatigue.
- A specification for an innovative thermal hydraulics modelling capability.
- Work has already begun on prioritised, initial model development.

Fuel Bundle Modelling



(a) Coarse-grid model (b) Detailed model

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