CCP-NTH
Management Committee Meeting 2
Executive Summary Report

CCP Project Nuclear Thermal Hydraulics

CCP-NTH Working Group Members (* for Management Committee Members)

Hector Iacovides*	University of Manchester
Brian Launder	University of Manchester
Dominique Laurence	University of Manchester
Tim Craft	University of Manchester
Shuisheng He*	University of Sheffield
Derek Jackson	University of Sheffield
Li Li	Nuclear AMRC, University of Sheffield
Mike Bluck*	Imperial Colleague London
Christos Markides	Imperial Colleague London
Mike Fairweather*	University of Leeds
Marco Colombo	University of Leeds
Michael Rushton	Bangor University
Mehdi Seddighi	Liverpool John Moores University
Eugene Shwageraus*	University of Cambridge
Peter Ireland	University of Oxford
Jack Nicholas	University of Oxford
Andrew Buchan	Queen Mary University
Edo Boek	Queen Mary University
Elia Merzari*	Penn State University/Argonne National Laboratory
Charles Moulinec*	STFC Daresbury Laboratory
Wei Wang*	STFC Daresbury Laboratory
David Emerson	STFC Daresbury Laboratory
Juan Uribe*	EDF Energy R&D UK Centre
Mike Rabbitt	EDF Energy Engineering
Bing Xu	EDF Energy Engineering
Christopher Sigournay	EDF Energy Engineering
Jiankang Li	EDF Energy Engineering
Carolyn Howlett	Frazer-Nash Consultancy
Richard Underhill	Frazer-Nash Consultancy
Adam Owens	Moltex
Ryan Tunstall	Rolls-Royce
Simon Hind	Rolls-Royce
Adam Flint	Rolls-Royce
Sam Treasure	Rolls-Royce
Mike Yule	Jacobs
Richard Stainsby	Jacobs
Chris Harrington	UKAEA
Steve Graham	National Nuclear Laboratory

Executive Summary Report

Produced by:	Wei Wang	05/01/2021
Reviewed by:	Shuisheng He, Charles Moulinec	06/01/2021

January 2021

1. Background

The aim of CCP-NTH is to support a community of researchers and engineers to develop and maintain computational methods and software packages to modernise the nuclear thermal hydraulics tools to meet the demands imposed through the development of advanced next generation nuclear reactor systems to be employed in the coming decades.

CCP-NTH aspires to achieve a number of specific objectives arranged in two work packages: WP1, Community building and networking and WP2, Methodology and code development and maintenance, which includes high fidelity modelling and simulation and robust CFD.

2. Highlights for the current reporting period (April 2020 – Dec. 2020)

2.1 WP1 Community Building & Networking

Meetings:

(1) The first Management Committee Meeting (5 May) ***(WP1-0)***

This meeting discussed a number of issues including terms of reference for the MC and WG, and Calls for proposals for visiting grants. It was decided (with no other options really) that most of the community building activities were to be hold back until situations change.

(2) The first Annual Technical Meeting via Zoom (1 Sep.) as a joint event with the Special Interest Group in Nuclear thermal hydraulics (SIG-NTH) with the morning focusing on the CCP afternoon on the SIG. ***(WP1-1)***

The CCP meeting included a summary of the plans and progress of the CCP activities, a well-received keynote talk from Prof Merzari of Penn State University (the CCP's international advisor), short presentations from each WG member and finally a useful general discussion. The Zoom meeting record has been circulated to WG members. The meeting was attended by over 50 attendees.

(3) A brief virtual meeting with CCP-Turbulence key personnel (16 Oct.) ***(WP1-3)***

This meeting discussed potential collaborations. Information on the key features of codes developed by each CCP is exchanged which was very useful (note both CCPs use CFD even though with different focuses). It was agreed to organise join event(s) in future.

Training/Users' Meetings *(WP1-6):*

(1) A User Group for CHAPSim (the community code to be developed by the CCP) has been set up. A CHAPSim user forum in SLACK has been created.

(2) The First CHAPSim Users' meeting was held on 4 November for existing users to discuss initial code version collected and users' special requirement on functionalities. Future meetings will extend the invitation to all CCP members who are interested

(3) The second CHAPSim Users'meeting – experience sharing in postprocessing was held on (15th Dec). A PhD student from Professor Shuisheng He's group has shared his development of postprocessing and data visualisation code for data produced by CHAPSim.

Website (WP1-10)

CoSeC is working on unifying schemes with a new content management system (CMS) for all CCPs as the current default CMS Drupal 7 will come to end of life by June 2021. Several CoSeC CCP/HEC Website Working Group Meetings have been carried out (13thOct, 20th Oct, 05th Jan).

Wei will work together with support teams from System Division (STFC) to build up a new website based on the selected new CMS (Wordpress) in the next couple of weeks.

Others:

The COVID-19 and associated travel restrictions significantly limit the community building activities planned (i.e., exchange of visitors). Our current adapted plans include two regular events: (i) User group meetings (virtual), roughly quarterly and (ii) Special topic seminars, 2 to 3 times a year.

2.2 WP2 Code Development and maintenance

DNS/LES Code *CHAPSim*:

(1) The activity related to code-development initially focused on the preparation and release of the first unified CHAPSim code by collecting different versions from different research groups.

(2) The second code-development activity is formatting/cleaning the CHAPSim code with new user-friendly input and output interfaces, to make the code more accessible.

(3) The third task is to add the function of the code to deal with liquid metals (ie. liquid sodium, liquid lead, liquid bismuth and liquid LBE) to expand its application to unique media for advanced nuclear reactors. Conjugate heat transfer has been developed and is included in a test version. The latest version of CHAPSim has been distributed to the main users for testing its application in their specific domains.

(4) Investigations into revising/re-developing the framework/ architecture of the CHAPSim with potential multiple dimensional parallisation and high order spatial accuracy. To this end, literature review, methods comparison, other codes investigation has been done to build up knowledges.

Robust CFD Solver *Code_Saturne*:

Some updates on SubChCFD activities: Couplings with resolved CFD and porous modelling have been developed through BEIS Digital Reactor Design –TH project; Some investigation/discussion are being made to consider potential integration of SubChCFD to Nuclear Virtual Engineering Capability (NVEC), another BEIS NIP project; a new PhD started at Sheffield to work on transient SubChCFD.

HPC:

(1) The performance of CHAPSim and Code_Saturne have been tested in ARCHER2 early access.

(2) Charles Moulinec and Wei Wang of STFC's Computational Engineering Group together with Co-investigators Prof. He and Dr. Liu (University of Sheffield) and collaborator Dr. Uribe (EDF), have been successful with the ARCHER2 Pioneer proposal "High-Fidelity Simulations to Improve Performance and Safety of PWRs". (Details refers to https://www.scd.stfc.ac.uk/Pages/CoSeC_News_Roundup_DEC2020.aspx)

3. Plans for the next 6 months

3.1 WP1 Community Building & Networking

Training/Users' Meeting

(1) CHAPSim Users' meeting in March?

Special topic seminars:

(1) the first special topic seminar in February?

Website:

(1) To set up the website based on the new CMS in Jan-Feb.
(2) To maintain the website

3.2 WP2 Code Development and maintenance

High fidelity simulations - CHAPSim:

(1) To rewrite CHAPSim with modulization, including functions of multiple dimensional parallelisation and high order accuracy.
(2) To add extra general scalar transport equations for users' application

Robust CFD - Code_Saturne

(1) To carry out "High-Fidelity Simulations to Improve Performance and Safety of PWRs" in the ARCHER2.

HPC:

(1) To profile the performance of the new CHAPSim in ARCHER2