Contribution ID: **23103** Type: **Paper**

Flow reconstruction of single-phase buoyant jet from sparse temperature measurements

Wednesday, 15 November 2023 10:40 (20 minutes)

Flow reconstruction of single-phase buoyant jet from sparse temperature measurements

Xicheng Wang, YiMeng Chan, Dmitry Grishchenko, Pavel Kudinov
Division of Nuclear Engineering, Royal Institute of Technology, KTH
Corresponding Address
xicheng@kth.se, ymchan@kth.se, dmitrygr@kth.se, pkudinov@kth.se

ABSTRACT
Measurement of the velocity field in thermal-hydraulic experiments is of great importance for phenomena interpretation and code validation. Direct measurement by means of Particle Image Velocimetry (PIV) is challenging in some multiphase's tests where the measurement system would be strongly affected by the phase interaction. A typical example can refer to the test with steam injection into a water pool where the rapid collapse of bubbles and significant temperature gradient makes it impossible to obtain main flow information in a relatively large steam flux.

The goal of this work is to investigate the capability of the use of data-driven methods for the flow reconstruction of the jet induced by steam condensation from sparse temperature measurement with ThermoCouples (TCs). The reconstruction is divided into 2 subtasks, that are (i) from sparse temperature measurements to complete temperature field, and (ii) from complete temperature field to complete velocity field. For the first subtask, several data-driven methods (e.g., linear regression, neural network) will be studied to build the mapping from measurement space to latent space with reduced dimensionality. Then, the relation between latent space and complete space will be encoded by Proper Orthogonal Decomposition (POD). For the second subtask, Physics Informed Neural Networks (PINNs) and linear regression are considered. The paper starts with a single-phase buoyant jet to narrow down the uncertainties of the proposed framework. Validated CFD scheme is used to generate the training data.

KEYWORDS: Data-driven, flow reconstruction, buoyant flow, physics informed neural networks.

Speaker Bio

Primary authors: Mr WANG, Xicheng (KTH); CHAN, Yi Meng (KTH)

Co-authors: Dr GRISHCHENKO, Dmitry (KTH); Prof. KUDINOV, Pavel (KTH)

Presenter: Mr WANG, Xicheng (KTH)

Session Classification: Day 3- Parallel Session - I : Thermal-Hydraulics

Track Classification: Nuclear Thermal-hydraulics