Special Issue

Advances in Thermal–Hydraulic and Multiphase Flow Research in Nuclear Engineering

Message from the Guest Editors

This Special Issue highlights how data-driven methods can improve fluid mechanics research and applications in nuclear engineering. We welcome work that uses machine learning, modern data analytics, and hybrid physics–data approaches to better understand, predict, and control complex thermal–hydraulic and multiphase flows in nuclear systems. Topics of interest include:

- Data-driven turbulence modeling and closure strategies for nuclear thermal–hydraulics;
- Surrogate models and fast prediction tools for CFD and system codes;
- Hybrid physics–ML models for flow, heat transfer, and mass transfer;
- Multiphase flow: boiling, condensation, two-phase instabilities, and critical heat flux (CHF);
- Flow-induced vibration, thermal mixing, stratification, and flow distribution;
- Reduced-order modeling, operator learning, and emulation of high-fidelity simulations;
- Sensor data + ML for flow monitoring, anomaly detection, and state estimation;
- Data assimilation and uncertainty quantification for thermal–hydraulic predictions;
- Experimental + simulation data fusion, benchmark datasets and validation practices;
- Interpretability, robustness, and V&V of data-driven tools for safety-relevant use.

Guest Editors

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Message from the Editor-in-Chief

Fluids (ISSN 2311-5521) is an international journal on all aspects of fluids in open access format: research articles, reviews and other contents are released on the internet immediately after acceptance. You are invited to contribute a research article or a comprehensive review for consideration and publication in *Fluids*. The scientific community and the general public have unlimited free access to the content as soon as it is published. Please consider *Fluids* as an exceptional, exciting enterprise ready to reward your trust, attention, and active participation.

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