Foreword

Special issue on Advanced Reactor Thermal Hydraulics Experiments and Modeling Supporting Verification and Validation Needs

Guest Editors

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It is our great pleasure to introduce this *Nuclear Science and Engineering* special issue focusing on thermal hydraulics experiments and modeling supporting verification and validation needs for advanced reactor development.

Earlier generations of nuclear reactors were successively developed because of the underlying technology development, and it is essential to the success of advanced reactors to develop advanced reactor technologies to enable a long-term future for nuclear power, which will be an important part of the global energy mix and contribute to the achievement of net-zero emissions. Advanced nuclear reactors are currently being researched and developed to meet the growing demand for energy, decrease dependence on foreign energy sources, and increase the benefits from fission energy, making it safer and more economically competitive.

The fundamental challenge of next-generation reactor concepts is to achieve a significant advancement in nuclear technologies while setting the stage for an economically viable commercial deployment of the new technologies. This special issue features a selected set of articles on the following topics: a critical review of heat pipe experiments, the design and development of a low-temperature surrogate-fluid heat pipe test facility, pressure drop determination in a seven-pin wire-wrapped rod bundle for a sodium cartridge loop using scaled water experiments and computational fluid dynamics simulations, flow-induced vibration of a solitary wire-wrapped cylindrical fuel element in axial flow that has applicability to liquid metal–cooled fast reactor cores, molten salt reactor safety and system-level analysis, molten salt pump journal bearings under hydrodynamic lubrication conditions, sensitivity studies for various operational and design parameters of the axial flow centrifugal bubble separator for liquid-fueled molten salt reactors, system model development for high-temperature test facility simulation, molten salt natural circulation flow modeling and analysis, quantification of deep neural network prediction when used as surrogate models for physical models, deep learning classification methods as a diagnostic tool for specific sets of experiments, and scaling of thermal-hydraulic phenomena and reliability of passive systems.

The primary objective of this special issue is to share findings and advances with the broad research community to support and accelerate development, demonstration, and deployment of next-generation advanced reactor concepts. We hope readers will find this special issue informative and helpful to their work.

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