Science and Technology of Nuclear Installations

Special Issue on

Multiphysics Multiscale Coupling Modeling for Nuclear Reactor and Its Uncertainty Quantification

CALL FOR PAPERS

The accurate prediction of nuclear reactor behavior using advanced numerical tools is an important issue for nuclear reactor design and safety analysis. The nuclear power plant is a complex nonlinear multiphysics, multiscale coupling system, as it requires consideration of the coupling among neutronics, thermal hydraulics, structural mechanics, chemical dynamics, and coupling between primary and secondary circuits. Moreover, there are a variety of uncertainty sources in each physical field and thus prediction involves the complicated propagation of uncertainty in the coupling system. Comprehensive, high-fidelity, multiphysics, multiscale coupling modeling with uncertainty quantification is a powerful numerical tool for the detailed analysis of both current and advanced reactor designs. However, the accurate prediction of nuclear reactor behavior still remains a challenging topic in the nuclear engineering community. Alongside advances in computational capability, there has been an exponentially growing interest in topics related to the advanced numerical methods and tools used in coupling modeling and its uncertainty quantification in order to pursue a realistic description of the physical behavior of nuclear power plants without conservative assumptions. Recently, emerging numerical methods and practical simulation tools significantly promote the development of related fields.

This special issue invites researchers from both academic and industrial backgrounds in nuclear reactors to share the latest and most significant achievements and promote recent developments in the area of nuclear reactor multiphysics coupling modeling and its uncertainty quantification. This includes the development of new nuclear reactor coupling methods, static and transient reactor behavior analyses using advanced coupling tools, new uncertainty methodology, and uncertainty analysis for the multiphysics modeling. Original research work, as well as critical review articles, is welcomed.

Potential topics include but are not limited to the following:

- Nuclear reactor multiphysics multiscale coupling methodology developments
- High fidelity computational methods for reactor coupling systems
- Advanced coupling algorithm developments for nuclear reactors
- Static and transient reactor behavior analyses using advanced coupling tools
- Uncertainty methodology developments for nuclear reactors (statistical methods, Bayesian methods, hybrid methods, and inverse uncertainty methods)
- Best-Estimate Plus Uncertainty (BEPU) for reactor physics, thermal-hydraulics, and fuel performance
- BEPU methods and results for GEN-IV and other new designs
- Challenges and recent trends for nuclear reactor multiphysics BEPU

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Papers are published upon acceptance, regardless of the Special Issue publication date.

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