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## Special issue: innovative nuclear energy technology

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Nuclear energy plays an important role in the long-term energy mix. According to World Nuclear Association (WNA), the nuclear power installation in China will approximate 400 GW<sub>e</sub> by 2050. To achieve high performance of the future nuclear reactors with respect to safety, sustainability, and economy, extensive research activities are ongoing worldwide to develop advanced nuclear energy systems and related technologies. Furthermore, it is important to match the needs in countries where there are high expectations for nuclear technology and in countries where rich expertise and research findings exist.

Keeping this background in mind, the editorial board of *Frontier in Energy* (FIE) decided to publish the special issue on “innovative nuclear energy technology”, of which the main purpose is to upgrade the status and future needs in the deployment/development of advanced nuclear energy systems and technologies.

This special issue contains 13 contributions which covers two aspects, i.e., (1) innovative nuclear energy systems, including GEN-III pressurized water reactors (PWR), liquid metal cooled reactors (LMR), gas-cooled space reactors, small modular reactors (SMR), and accelerator driven sub-critical reactors (ADS), and (2) advanced nuclear energy technology with the focus on advanced safety technologies, including experimental confirmation and numerical analysis.

Three contributions deal with the state-of-the-art of two innovative reactors. Schaffrath et al. review the international development of SMR with a focus on the safety strategy and the qualification of numerical analysis tools, whereas Gu and Su describe the system design, the development and the future research and development needs of the Chinese ADS. In addition, Yang et al. address one of the sodium-cooled fast reactor (SFR) designs, which applies supercritical CO<sub>2</sub> cycle and does belong to the GEN-IV reactor concepts.

Nuclear thermal-hydraulics and safety (TH&S) are the key subject of this special issue. Two contributions review the state-of-the-art and future challenging tasks of TH&S of two different types of reactors, one for liquid metal cooled reactors focusing on the research progress in Europe (by Roelof et al.), and the other for water cooled reactors (by Dauria).

Both research methodologies, i.e., experimental and numerical approach, are included in this special issue. Three contributions are devoted to the experimental demonstration of advanced safety measures of various PWRs and address the decay heat removal system of AP1000 (by Qiu et al.), the severe accident mitigation systems of WWER (by Pantyushin et al.), and the hydrogen safety and radioactive source terms in containment (by Gupta et al.), respectively.

Attention is also paid to the advanced numerical analysis technique with five contributions, using both system thermal-hydraulics (STH) and innovative three-dimensional computational fluid dynamics (CFD) techniques. The safety performance of a gas-cooled space reactor is demonstrated by Wang et al. based on STH analysis. Innovative CFD technologies are applied to analyze the thermal-hydraulic performance inside the complex PWR pressure vessel (by Wang et al.) and the multi-phase flow and heat transfer behavior under accident conditions in LMR by Kawakami et al. and Yokoyama et al., using the moving particle semi-implicit method (MPS). This special issue is rounded by the paper of Luo et al., which is devoted to the neutron-physical design of innovative nuclear

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reactors using the advanced Monte Carlo code RMC.

*Frontiers in Energy*, as a journal of transactions of Chinese Academy of Engineering (CAE), is a peer-reviewed international journal. It aims to promote rapid communication and dialogue among the researchers, scientists, engineers and policy makers in the areas of energy and power engineering in China and abroad. This special issue is in good accordance with the aims of *FIE* and will surely foster the scientific and technical exchange between the nuclear communities in China and other countries. Furthermore, it will be a valuable knowledge upgrade in advanced nuclear energy technology.

With the publication of this special issue I would like to express my deepest gratitude to members of the editorial board, authors (also those whose papers were not included in this special issue due to some reasons), reviewers, and editorial office staff, for their enormous efforts to make possible the publication of this special issue.

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