Editorial: Nuclear Power Plant Equipment Prognostics and Health Management Based on Data-Driven Methods

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Editorial on the Research Topic

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In response to the fierce competition in the energy market, nuclear power companies are considering operating nuclear power plants in a more economical, efficient, and safe manner. Besides, with the upgrading of nuclear power plants, systems and equipment are becoming more sophisticated and expensive (Kwon et al., 2018), which poses challenges to the timeliness, accuracy, and forward-looking of operation and maintenance (O&M) practices (Al Rashdan and St Germain, 2018; Liu and Wang, 2019). Traditional O&M practices with periodic maintenance as the core need to be further upgraded to meet these requirements. As a novel O&M strategy, data-driven health management of nuclear power plant equipment is gaining more and more attention (Patel and Shah, 2018). On the one hand, the digitization of nuclear power plants provides a rich source of data. On the other hand, the development of data science and technology, especially the development of big data technology and artificial intelligence technology represented by machine learning and deep learning, provides technical means for efficiently mining and learning laws and knowledge from data. This Research Topic explore's the application of the latest technical means such as big data, artificial intelligence, deep learning, etc. for the prognostics and health management (PHM) of crucial equipment of nuclear power plants. We include the advanced sensor technology. For example, Chu's work *Study on Measure Approach of Void Fraction in Narrow Channel Based on Fully Convolutional Neural Network* (Chu et al.). Besides, we have three articles about the data-driven approach in condition monitoring, which include Xu's work *Research on Time-Dependent Component Importance Measures Considering State Duration and Common Cause Failure* (Xu et al.), Huang's work *Data-Driven-Based Forecasting of Two-Phase Flow Parameters in Rectangular Channel* (Huang et al.), and Wang's work *A Method of Containment Leakage Rate Estimation Based on Convolution Neural Network* (Wang et al.).

For the data-drive approach in fault diagnosis, we collect four articles, they are Wu's *A Framework for Monitoring and Fault Diagnosis in Nuclear Power Plants Based on Signed Directed Graph Methods* (Wu et al.), Hu's *Data-Driven Machine Learning for Fault Detection and Diagnosis in Nuclear Power Plants: A Review* (Hu et al.), She's *Diagnosis and Prediction for Loss of Coolant Accidents in Nuclear Power Plants Using Deep Learning Methods* (She et al.), and Wu's *A Framework of Distributed Fault Diagnosis for Nuclear Power Plant* (Wu et al.). We also

have one article for the data-driven approach in prognostics, it is Wang's *Remaining Useful Life Prediction Based on Improved Temporal Convolutional Network for Nuclear Power Plant Valves* (Wang et al.). Zhao's *Prognostics and health management in nuclear power plants: an updated method-centric review with special focus on data-driven methods* (Zhao et al.) provides a systematic overview of the full PHM spectrum and an in-depth survey of its modeling approaches, placing a strong emphasis on the state of the art of data-driven methods for PHM. Finally, Sun's *Development and*

Validation of Multiscale Coupled Thermal-Hydraulic Code Combining RELAP5 and Fluent Code (Sun et al.) contributes to the simulation capability of computational tools for nuclear systems.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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