The 14th International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE2024)

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Special Session on:

Reliability Design and Assessment of Nuclear Power Facilities

Nuclear energy is an internationally recognized efficient, clean, low-carbon green energy. It has been included in China's energy development strategy and is an important guarantee for China to achieve sustainable development. Focusing on nuclear energy, China's nuclear industry has formed a series of important industries including nuclear power construction and operation, nuclear fuel cycle, nuclear emergency and nuclear facility decommissioning, and all of them are playing an irreplaceable role in the national economy and national security.

During the design stage of nuclear power facilities, the peak surface temperature of the fuel rods is a key parameter that directly impacts the heat transfer performance and safety of the nuclear fuel components. To ensure the safe operation of nuclear fuel element, the thermal design criteria for the core of a nuclear fuel element stipulate that the peak surface temperature of the fuel rods must be below a certain limit to maintain its integrity and prevent the leakage of radioactive materials. Reliability-based design optimization of the fuel assembly is needed to minimize the peak surface temperature of the fuel rods with overall heat transfer efficiency and cooling water pressure drop as constraint conditions. During the operation of a nuclear reactor, the key components, such as control rod drive mechanisms, play a vital role for the reliable and safe operations of nuclear power facilities, On the other hand, strong radioactive gamma rays and neutrons will be released to the outside, making it difficult for personnel to carry out production, maintenance, emergency and other operations at close range. There is an urgent need to develop operating robots suitable for a variety of nuclear radiation scenarios.

Therefore, this special Session aims to present original research on the reliability-based design optimization and reliability assessment of nuclear power facilities, including, but are not limited to, equipment in the primary circuit loop, fuel elements, operating robots in the radiational environment, offering innovative insights for academia and showcasing the latest compelling applications for the nuclear industry.

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