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Experiment and Modeling Efforts to Support Development and Deployment of Advanced Energy Systems

Advanced energy systems are the next generation of energy systems with self-control and monitoring attributes along with passive safety measures that are being designed and developed across the globe. Self-control of primary processes refers to the reactors inherent safety, whereas passive safety features are vital in operation when strong deviation of normal process behavior occurs. For supporting the verification and validation for these novel systems there are modeling and experimental efforts being supported under various Department of Energy programs. Both these efforts need to synergize to support a successful accelerated deployment. This article provides an overview on the test beds being designed and developed along with the modeling efforts in the Multiphysics Object-Oriented Simulation Environment (MOOSE) that supports multiphysics modeling and simulations, i.e., neutronics, thermal-hydraulics, thermomechanics, and thermochemistry, of advanced nuclear reactors for engineering design, safety studies, licensing, and operational support. The experiments being designed and carried out will support technology maturation, and reduce uncertainty and risk associated with the design, operation, and deployment of next generation energy systems, such as small modular reactors and microreactors.

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