Coupling Techniques for Multiphysics Modeling of Molten Salt Reactors

Molten Salt Reactors (MSRs) are receiving increased attention arising from their potential advantages compared to conventional reactors; these include inherent safety features and reduced costs. The circulating fuel in an MSR induces a strong coupling between neutronics and thermal hydraulics, in part due to the delayed neutron field being affected by the fuel velocity fields, thus requiring new modelling approaches. In this paper a conventional operator-splitting and a multiphysics coupling technique between neutronics and thermal hydraulics, applied to a simple test geometry, are compared. Commercial software, ANSYS CFX for thermal hydraulics and MCNP for neutronics, are applied in the conventional operator-splitting technique, whereas multiphysics coupling is investigated by means of open source software OpenFOAM. In particular, fuel temperature, velocity and power distribution fields obtained by the two approaches are presented and compared.

General information
State: Published
Organisations: Radiation Physics, Center for Nuclear Technologies
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Number of pages: 12
Publication date: 2018
Peer-reviewed: Yes
Source: PublicationPreSubmission
Source-ID: 164387903
Research output: Research - peer-review › Paper – Annual report year: 2018