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Transient 3D simulations for the ASTRID reactor: preliminary results for the ULOF initiation phase

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An Unprotected Loss Of Flow transient (ULOF) in the 1500MWth Advanced Sodium Technological Reactor for Industrial Demonstration (ASTRID) reactor is investigated with SIMMER-IV, a 3D multi-phase, multi-velocity and multi-component fluid-dynamics and neutronics code. The 2D RZ code version, SIMMER-III, is a working horse for fast reactor severe accident studies at KIT and other institutions, but the 2D approach affects simulation of reactivity feedbacks and of behavior of reactor materials under accident conditions. On the other hand, 3D SIMMER ULOF calculations take a lot of time and computer memory and were not tried for a full-vessel pool-type fast reactor model at KIT and EdF before recently.

Recent developments for SIMMER-IV, including introductions of a new neutron transport solver based on the PARTISN code and of a new procedure for generation of few-group cross-sections during the transient, offer new simulation capabilities. Also more computer power is available now. Therefore, an effort was done at KIT, in collaboration with EdF, to perform calculations for a full-vessel 3D model of the primary ASTRID circuit. After a first attempt, modifications were introduced in the code and the employed reactor model for improving their performance.

In the paper we inform on our experience with 3D SIMMER calculations, present preliminary results of 3D steady state and transient simulations for the ULOF initiation phase, do preliminary comparisons with results of 2D analyses.

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