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Analyses of unprotected transients in GFR (ALLEGRO) and SFR reactors supporting the group constant generation methodology

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In this study, the fuel, the coolant, the cladding and the wrapper temperature reactivity coefficients were calculated with Serpent Monte Carlo code for the ALLEGRO demonstrational GFR core and for an SFR core with 3600 MWth power. The results were compared with each other and with thermal reactor reactivity coefficients, and it was found that the thermal expansion of the core structural elements has significant effect on the reactivity for fast spectrum reactors. Detailed explanation was given for the reactivity coefficients. Additionally, the importance of the reactivity coefficients during unprotected transients were determined with thermal-hydraulics simulations using ATHLET 3.1A code. The calculations were based on the determination of evolving maximal fuel, cladding and coolant temperatures. The uncertainties were also calculated for these parameters considering the uncertainties of the reactivity coefficients. Our results can be used for further group constant parametrization.

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