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Actual Status of the Development of Multigroup XS Libraries for the Gas-cooled Fast Reactor in Slovakia

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Slovakia is involved in the development of the ALLEGRO reactor, the demonstrator of the unique GFR technology. Since the Gas-cooled Fast Reactor lacks any applicable experimental data, the design and optimization of its core must rely on data from similar reactor concepts and on calculations using Monte Carlo and deterministic methods. Although these two methods differ in their nature, both require appropriate nuclear data libraries. The present paper describes the actual status of the development of multigroup XS libraries, optimized for fast, but precise deterministic calculations of the GFR 2400 reactor. The optimization of the XS library starts with a similarity assessment, to identify benchmark experiments, which could provide experimental data relevant to GFR 2400. The selected benchmarks are evaluated in the discrete ordinates PARTISN transport code, based on integral parameters as well as sensitivity profiles. In order to gather the required sensitivity data, the benchmark calculations are performed in very fine energy structure. For these calculations the previously developed SBJ v2015 XS library is used. In order to obtain the overall sensitivity profile of the GFR 2400 reactor the same approach is applied, using the SBJ v2015 XS library. The overall sensitivity profile is the sum of absolute sensitivity profiles of all relevant nuclides and reactions. This sensitivity profile is used to analyze the GFR 2400 neutron spectrum and to develop an optimized intermediate-group energy structure for the SBJ v2016 XS library. This intermediate-group energy structure is used to reevaluate the selected benchmark experiments and to compare the performance of the SBJ v2016 XS library with MCNP5, with the SBJ v2015 XS library as well as with other multigroup XS libraries available for fast reactor calculations. In the final step the new optimized SBJ v2016 XS library is applied on the full core GFR 2400 reactor model in DIF3D and compared with MCNP5 results based on core-wide and group-wise distributions of neutron physical parameters.

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