Group constant generation for the GEN IV ALLEGRO reactor

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Abstract:

Group constant generation for fast spectrum and thermal reactors has several significant differences. For example, in the case of thermal reactors, two or four macro energy group is sufficient to use the few group constants in macro codes. The neutron spectrum is shifted to higher energies in fast reactors, and the cross-sections of the nuclei change rapidly in that region, thus more detailed group structure needed for precise macro calculations. The ALLEGRO gas-cooled fast reactor is currently under development, where group constants can be used for the core optimization and for the study of three-dimensional effects. The methodology of the group constant generation process was presented, in detail with the following topics: optimization of the macro energy group structure, optimization of the nodalization and parameterization according to thermal effects. The group constants are generated using the Serpent Monte Carlo code, then applied and tested in the KIKO3DMG nodal code. The KIKO3DMG usually used in diffusion approximation, but higher degree polynomials can be taken into account (e.g. SP3). In the future, the kinetics of malfunctions will be studied with the coupled KIKO3DMG-ATHLET code system in three dimensions.