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General method for optimization of neutron-energy group structure of cross section libraries for different type of reactors –first approach

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Nuclear cross sections strongly depend on neutron energy (e.g. their behaviors in resonance regions). To represent some reactions of resonant nuclides accurately, more than 100,000 energy points are required. Most nuclear codes cannot handle this vast amount of data. That is why, the pointwise cross sections are averaged over energy groups to form multi-group cross sections. These group constants depending on the energy group structure and weight function can be used for specific types of problems, such as thermal reactors, fast reactors, fusion problems or shielding calculations. To improve the accuracy of neutronic calculations, it is necessary to reduce the uncertainties associated with the cross sections. There are three major factors that affect the accuracy of cross section generation. These include energy group structure, self-shielding method, and collapsing methodology.
There currently exists very little information that outlines the process used for generating new cross section group structures.

There also exists no readily-usable tools for optimizing these group structures. This work has focused on optimizing the group structure of a fine-group libraries (~1000 groups) to a group structure suitable for fast, yet accurate deterministic transport calculations using SCALE code system. This is the first approach to finding a universal method for optimization of neutron-energy group structure of multi-group cross section libraries for any type of nuclear reactor.

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