

Sensitivity Theory approach to Implementation of the Subgroup Method for Resonance Treatment in Heterogeneous Systems

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Abstract

As an effort to resolve the whole-core flat flux assumption introduced in the formulation of the slowing down fixed source problem appearing in the application of the subgroup method for resonance treatment in heterogeneous systems, a new definition of the equivalence cross section is introduced which establishes equivalence between a heterogeneous and a homogeneous system in terms of equal sensitivity of reaction rate on the perturbation in the resonance cross section. The derivation to obtain the heterogeneous sensitivity coefficient is carried out through the use of the sensitivity theory to yield a fixed source problem which is different only in the right hand side source term from that of the conventional formulation. This derivation guarantees positive equivalence cross sections unlike the conventional formulation. The new approach is evaluated by employing an analytic P_n solver for a simple one dimensional two-region problem consisting of fuel and moderator. The results indicate that the new approach produces conditionally better results than the conventional formulation especially when the fluxes at the high energy range are greater in the moderator regions than in the fuel regions.