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CBZ: the deterministic reactor physics code system

Nowadays, several highly qualified and easy-to-use continuous-energy Monte Carlo particle transport codes have been developed, and numerical simulations related to the nuclear reactor physics and the radiation shielding are conducted with them. However, the deterministic method is still important since it is free from statistical uncertainties and simulation results can be obtained faster with it than with the Monte Carlo codes. In the deterministic methods, energy discretization is required, so energy-averaged (multi-group) nuclear data are essential.

A deterministic reactor physics code system CBZ has been being developed at Hokkaido University for the research work in the field of nuclear reactor physics, and now it is utilized for various applications in the nuclear reactor physics such as fast reactor core design work. The application field of CBZ is now being enlarged to the temperature profile calculations at the nuclear waste repository site and the optimization study of the neutron source for medical
use.

With CBZ, various types of numerical simulations can be conducted such as the nuclear reactor kinetics calculations with the explicit fission product model, nuclear fuel depletion calculations with the detailed or compressed depletion chain, sensitivity and uncertainty analyses on nuclear fuel burnup characteristics with the help of the generalized perturbation theory, and so on. For these simulations, relevant nuclear data such as reaction cross
sections for neutron and photon, photon generation data, decay and fission yield data for fuel burnup and delayed neutron emission, and the covariance data.

As mentioned above, CBZ is based on the deterministic method, so the multi-group nuclear data are essential. The NJOY99 and NJOY2016 have been used to generate multi-group data so far, but now the new codes FRENDY and FRENDY/MG have been adopted to the multi-group data generation system in CBZ.

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