DEVELOPMENT AND APPLICATION OF COUPLED MONTE CARLO-S_N Auto-

MODELING TOOL RCAM1.0

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Shielding calculations of nuclear facilities such as ITER are complicated because their complex geometries with large size. The deep penetration of radiation through bulk shields is a severe challenge for the Monte Carlo particle transport simulation technique. Coupled Monte Carlo-discrete ordinates (also called as S_N) three-dimensional particle transport simulation computational scheme is used to solve above problem. The Monte Carlo method is used to simulate the particle generation and transport in the target region with complex geometry, and the S_N method is used to treat the deep penetration problem in the bulk shield. However, the construction and visualization of the target geometry within the particle transport computational methods is a significant obstacle [1]. Describing and verifying the three-dimensional geometry model is very time-consuming and error-prone. How to translate geometry definitions between the CAD environment and the computational environment is a big challenge task.

The FDS Team has developed some automatic modeling codes against above problems [2]. RCAM (Radiation Coupled Automatic Modeling) has a capability to convert CAD model to input file for coupled MC-S_N computation. It decomposes the problem space into three parts: MC region, coupled region, and S_N region. The Monte Carlo simulation aiming at MC model and coupled region is performed to obtain necessary information, such as particle type, weight, flight direction, spatial position, energy of particle tracks cross the common surface. The discrete ordinates angular flux can then be evaluated by using a mapping approach based on the recorded Monte Carlo particle tracks. Then S_N code aiming at coupled region and S_N region simulates deep penetration problem [3].

RCAM has been benchmarked by the shielding analysis of ITER. The neutron flux across the bioshield was calculated, analysis results show that $MC-S_N$ scheme can dramatically reduce CPU time for getting similar result with the help of RCAM.

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