

# 基于 RMC 的接续面源功能开发验证

## 摘要

在蒙特卡洛模拟过程中，由于几何较大且复杂，在统计较远处位置信息时，会受到粒子数不够多而得不到足够精确结果的影响。一种可行的方法就是，采用接续面源。即在模拟时，记录穿过某个面或者某个栅元里面粒子的信息。然后在下一次计算当中，通过读取这些粒子径迹信息，即把这些信息作为源，然后通过对这些粒子进行分裂、偏倚等操作进行模拟，达到减少方差，得到较精确效果的手段。前在 MCNP 中有进行 MC-MC 耦合计算的功能，通过关键字 SSW(写面源卡) 记录穿过指定面的粒子信息，包括粒子能量，权重，位置，飞行方向等，然后形成了二进制文件 wssa, 提供给读面源 (SSR), 作为耦合接续计算的初始面源，然后可以对粒子进行分裂、偏倚等操作，达到减方差目的进而得到较为精确结果的手段。本研究基于清华大学工程物理系核能科学与工程管理所开发的堆用蒙特卡罗程序 RMC，实现了 RMC 中的接续面源功能。

## 关键词

分段-衔接计算；面源记录；SSW/SSR；RMC

## Abstract

In the Monte Carlo simulation process, due to the large and complex geometry, when counting the information of distant positions, the number of particles is not enough and the results are not accurate enough. A feasible method is to use a continuous surface source. That is, during the simulation, record the information of particles passing through a certain surface or a certain grid element. Then in the next calculation, by reading these particle track information, that is, taking this information as the source, and then simulating these particles by splitting, biasing and other operations, the variance is reduced and a more accurate effect is obtained. There is a function for MC-MC coupling calculation in MCNP. The keyword SSW (write surface source card) is used to record the information of particles passing through the specified surface, including particle energy, weight, position, flight direction, etc., and then a binary file wssa is formed and provided to the read surface source (SSR) as the initial surface source for the coupled continuous calculation. Then the particles can be split, biased and other operations can be performed to reduce the variance and obtain more accurate results. This study is based on the reactor Monte Carlo program RMC (Wang et al., 2015) developed by the Institute of Nuclear Energy Science and Engineering Management, Department of Engineering Physics, Tsinghua University, and realizes the function of connecting surface sources in RMC.

## Keywords

Segment-connection calculation; surface source recording; SSW/SSR; RMC

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