Abstract

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Simultaneous Optimization of Tallies in Difficult Shielding Problems

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SIMULTANEOUS OPTIMIZATION OF TALLIES IN DIFFICULT SHIELDING PROBLEMS

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Purpose:

For many years, hybrid methods that use information derived from deterministic calculations have been studied in attempts to speed up Monte Carlo calculations. CADIS (Consistent Adjoint Driven Importance Sampling) is one such methodology that has been successfully applied to both MCNP (in the ADVANTG patch) and to Monaco (part of SCALE 6) to use an approximate TORT calculation to determine both the transport weight window target values and a biased source distribution to optimize one tally of interest in the Monte Carlo (MC) code. What is needed is a way to obtain more than one tally in the same MC calculation with each tally having roughly the same relative uncertainty — simultaneous optimization.

Methods and Materials:

The MC tallies appear in the adjoint calculation as adjoint sources. By weighting each of these by the inverse of the expected tally response (flux, dose, etc.), the final adjoint flux creates an importance map and biased source that more uniformly converge the tallies in the final MC calculation.

Results:

This new method, using a forward-weighted adjoint source and the CADIS methodology (called FW-CADIS), is demonstrated on a difficult shielding problem — finding the dose equivalent rates all along the boundary of the controlled area of an independent spent fuel storage installation.

Conclusions:

The FW-CADIS method can be used to calculate a mesh tally in which the dose equivalent rate varies over orders of magnitude but the relative uncertainties are roughly equal.

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