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A Jacobian-Free Newton-Krylov Implementation of Nonlinear Diffusion Acceleration Using Monte Carlo High-Order Function Evaluations

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In order to treat complex geometries more exactly, simulate physics more accurately, and avoid the issues with discrete ordinates methods, Monte Carlo methods for solving the neutron transport equation have become more widely used. In this talk, we discuss an implementation of Nonlinear Diffusion Acceleration in which the high-order equation (the neutron transport equation) is solved using an adapted Monte Carlo function evaluation instead of using a standard deterministic transport sweep. We begin with a basic introduction to the neutron transport equation, discuss a deterministic evaluation of Nonlinear Diffusion Acceleration and conclude with an in-depth look into a Jacobian-Free Newton-Krylov implementation of Nonlinear Diffusion Acceleration in which our high-order function evaluations are performed using Monte Carlo simulation.