AN ABSTRACT OF THE DISSERTATION OF

Douglas N. Woods for the degree of Doctor of Philosophy in Nuclear Engineering presented on June 16, 2018

Title: Discrete Ordinates Radiaiton Transport using High Order Finite Element Spatial Discretiza Geometry on Meshes with Curved Surfaces

Abstract approved:

Todd S. Palmer

The high-order finite element $S_N$transport equations are solved on several test problems to investigate the behavior of the discretization method on meshes with curved edges in X-Y geometry. Simpler problems ensured the correct implementation of MFEM, the general finite element library employed. A convergence study using the method of manufactured solutions demonstrates the convergence rate as a function of number of unknowns for meshes whose sides are described by polynomial curves of increasing order. Optically thick and diffusive problems indicate the DGFEM transport solution trends toward a numerical solution of the diffusion equation, though a rigorous diffusion limit analysis has not yet been performed. A direct solve approach to computing the angular flux unknowns simultaneously is presented as an alternative to source iteration that involves linear algebraically inverting the "streaming plus collision minus scattering" operator. These results serve as a proof-of-concept of this spatial discretization method.