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Title: PERICLES **AND** ATTILA RESULTS FOR THE C5G7 MOX BENCHMARK PROBLEMS

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Pericles and Attila Results for the C5G7 MOX Benchmark Problems
(invited)

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Introduction

Recently the Nuclear Energy Agency has published a new benchmark [1] entitled, "C5G7 MOX Benchmark." This benchmark is to test the ability of current transport codes to treat reactor core problems without spatial homogenization. The benchmark includes both a two- and three-dimensional problem. We have calculated results for these benchmark problems with our Pericles and Attila [2] codes. Pericles is a one-,two-, and three-dimensional unstructured grid discrete-ordinatescode and was used for the two-dimensional benchmark problem. Attila is a three-dimensional unstructured tetrahedral mesh discrete-ordinate code and was used for the three-dimensional problem. Both codes use discontinuous finite element spatial differencing [3]. Both codes use diffusion synthetic acceleration (DSA) for accelerating the inner iterations.

Description of Work

We have used our Pericles code to calculate the two-dimensional C5G7 MOX Benchmark problem. We used unstructured quadralateral elements. The computational grids were created using ICEM CFD Engineering Quad™. The coarse mesh consists of 1'7,465 quads and the fine mesh consists of 62,079 quads. We have used our Attila code to calculate the three-dimensional C5G7 MOX Benchmark problem. The tetrahedral grid was created using a combination of ICEM CFD Engineering's meshing modules. The mesh contains 954,427 tetrahedra. All grids preserve the volume of each material.

Although we have examined several different angular quadrature sets, we settled on using the Square-Tchebyschev-Double-Legendre quadrature set. The convergence criterion for the eigenvalue and pointwise fluxes were 1.0×10^{-5} and $\mathbf{1.0} \times 10^{-4}$, respectively.

We performed most of the parameter studies for the two-dimensional problem simply because the computational effort for the two-dimensional problem is considerably less than the three-dimensional problem. Here we use two different mesh refinements and varying orders of angular quadrature. Our results are given in the next section.

Computational Results

The Pericles eigenvalue and pin power results for the two-dimensional benchmark problem are given in Tables 1. Clearly there are small differences between the coarse

3. T.A. Wareing, J.M. McGhee, J.E. Morel and S.D. Pautz, "Discontinuous Finite Element S_N Methods on Three-Dimensional Unstructured Grids", *Nucl. Sci. Engr.*, Volume 138, Number 2, July 2001.