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## The Design of Hardware Accelerator for Compute-Intensive Tasks in Solving Neutron Transport Problems by Method of Characteristics

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The Method of Characteristics (MOC) has been proved as an effective method to solve many-group neutron transport problems for full core Light Water Reactor (LWR) analysis. The method has been widely used to solve 2D lattice physics problems due to its ability to provide high accuracy solutions to problems with geometric details. Due to the computational and memory expensive of solving full core many-group neutron transport by 3D MOC, efforts have been focused on 2D/1D coupling methods which solve 3D problems as a coupled system of 2D MOC solver for radial planes and other deterministic solver for 1D axial columns. With today's widely availability of massively multi-node, multi-core computers together with computational hardware such as Graphics Processing Unit (GPU), Field Programmable Gate Array (FPGA), and Application-specific Integrated Circuit (ASIC) to accelerate high-cost computations, using 3D MOC to solve full core many-group neutron transport problem for LWR analysis is feasible. This presentation describes the design and implementation of a hardware accelerator for compute-intensive operations in MOC. The implementation can be used for both 2D and 3D MOC solvers since the design is independent from problem geometry and dimension. Each accelerator can be installed in each node of a multi-node system to handle the high-cost computations where the node CPU handles low-cost computations and processes such as geometry construction, track generation, ray tracing, node communication, input/output processing, etc. The design has been implemented and synthesized with several different technologies. The results demonstrate that the design yields good computational speed with desired accuracy.

## Minioral

No

## **IEEE Member**

No

## Are you a student?

No

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