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**A Nonlinear Combination of CMFD (Coarse-Mesh Finite Difference)  
and FMFD (Fine-Mesh Finite Difference) Method**

Ho Cheol Shin, Yong Hee Kim, Yong Bae Kim, and Sung Man Bae

Korea Electric Power Research Institute  
Nuclear Power Laboratory  
103-16, Munji-dong, Yusung-gu Taejon, 305-380, Korea

**Abstract**

An efficient acceleration scheme is introduced for the fine-mesh finite difference method, where the coarse-mesh finite difference method is nonlinearly coupled with the high order finite difference representation of the neutron diffusion operator. The coarse-mesh operator is iteratively corrected such that its solution is equivalent to that of the fine-mesh operator. The correction factors are updated by using the one-node-based high order solution, not the two-node solution as in the conventional nonlinear nodal methods. The efficiency and accuracy of the new method is demonstrated over a benchmark problem (IAEA-2D), relative to a production code, VENTURE. Numerical results show that the computational speed of the new algorithm is 10 ~ 15 times faster than that of VENTURE, without compromising the accuracy of the solution. In addition to the fast convergence, the new algorithm is easy to implement and also is highly parallel.