A Preconditioned Conjugate Gradient Method for the FOSLS Formulation of the Boltzmann Transport Equation

B. Lee *

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Abstract. Solving the system of partial differential equations of the PN discretization of the Boltzmann transport equation is difficult. For realistic applications, the number of pde's in this system can be $O(100)$, and each of these equations couple strongly (2'nd order) with each other. A system multigrid solver for these equations reasonably proves to be non-scalable as the number of pde's increases. In this talk, we present a simple preconditioned conjugate gradient iteration which seems to be relatively robust as the number of pde's increases. The preconditioner consists of a 2×2 system diagonal block with each block describing only the like-parity coupling equations. Each of these blocks are approximately inverted with one or two V-cycles, and the overall performance of the pcg iteration can be analyzed by analyzing only the diagonal blocks of this preconditioner.

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