A DIRECT SPECTRAL COLLOCATION METHOD FOR RADIATIVE HEAT TRANSFER INSIDE A PLANE-PARALLEL PARTICIPATING MEDIUM WITH A GRADED INDEX

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ABSTRACT. A spectral collocation method based on discrete-ordinates equation is employed to directly solve one dimensional radiative heat transfer in an absorbing, emitting and scattering medium with a graded index. Numerical results by the direct spectral collocation method are compared with available data in references. The results show that the direct spectral collocation method has good accuracy for one dimensional radiative heat transfer even with space-dependent anisotropic scattering and graded index medium. The CPU time cost comparisons against the resolutions between the direct and iterative solvers are made using MATLAB computer languages. The CPU time cost of direct solver is shorter than that of iterative solver for the same number of nodes.

KEYWORDS: Direct spectral collocation method; Discrete-ordinates method; Graded index; Radiative heat transfer; Participating medium