Generation of the Analytic Solutions of the Multigroup Discrete Ordinates Transport Equation in Slab Geometry by Using Infinite Medium Green's Function

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Abstract

Analytic solutions of the multigroup discrete ordinates transport equation with linearly anisotropic scattering in slab geometry are obtained by using infinite medium Green's function (IMGF) and Placzek's lemma. In this approach, the infinite medium Green's function is derived analytically by using the spectral analysis for the multigroup discrete ordinates transport equation and its transposed equation, and this infinite medium solution is related to the finite medium solution by Placzek's lemma. The resulting equation leads to an exact relation that represents the outgoing angular fluxes in terms of the incoming angular fluxes and the interior inhomogeneous sources for each slab. In multi-slab problems, the slabs are coupled through the interface angular fluxes. Since all derivations are performed analytically, the method gives exact solution with no truncation error. After the interface angular fluxes are calculated, the continuous distribution of the angular flux (i.e., analytic solution) in each slab are calculated straightforwardly with IMGF. Therefore, in our method, the number of meshes that is equal to the number of the homogeneous slabs is sufficient.