NE520 : S_N Code Project

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In all cases considered below, assume isotropic scattering ($\Sigma_{s,l} = 0$, $l \geq 1$), set the S_N quadrature order to $N = 8$, the total cross section $\Sigma_t = 1$, the fission cross section $\Sigma_f = 0.0$ and the source iteration convergence tolerance to $\epsilon = 10^{-6}$.

Case 1. Assume an incident beam on the left boundary of the slab along the most forward direction and a vacuum condition on the right boundary. Assume the medium does not have a volume source. Compute the scalar flux for the following parameters:

- scattering cross section $\Sigma_s = 0.5$
- slab thickness $L = 5$
- number of spatial cells $I = 10, 20, 50$ and 100
- weighted diamond parameter $\alpha = 0.5$, i.e., diamond differencing

Plot the scalar flux, comparing results for different numbers of spatial cells on the same graph. Tabulate the number of source iterations required to converge the computation.

Case 2. Repeat Case 1 with weighted diamond parameter $\alpha = 0$, i.e., step differencing.

Case 3. Repeat Case 1 for isotropic incidence on the left face (normalized to unit incident current) for both step and diamond differencing.

Case 4. Repeat Case 1 for the following modified set of parameters:

- $\Sigma_s = 0.99$
- $L = 100$
- $I = 100$
- $\alpha = 0.5$

Case 5. Assume an incident beam on the left face and an albedo condition on the right face, with the following parameters:

- $\Sigma_s = 1$
- $L = 5$
- $I = 20$
- $\gamma = 0.5,\ 1$

Case 6. Consider a spatially uniform isotropic source and normalize the source strength so that the total number of source neutrons in the slab is unity. Assume free surface (vacuum) boundary conditions and obtain the scalar flux in the slab using the following parameter ranges:

- $\Sigma_s = 0.9, 0.99$
- $L = 100$
- $I = 100$
- $\alpha = 0.0, 0.5$ (step and diamond differencing)