NE 515 (520) : S_N Code Project

A.K. Prinja

1. 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. Obtain and plot the scalar flux in the slab using the following parameter ranges and tabulate the number of iterations required for convergence.

   - Quadrature order $N = 8$
   - Source iteration tolerance $\epsilon = 10^{-6}$.
   - $\Sigma_t = 1$, $\Sigma_f = 0.0$, $\Sigma_s = 0.9, 0.99$
   - $L = 100$
   - $I = 100$
   - $\alpha = 0.0, 0.5$ (step and diamond differencing)

2. Consider the so-called Reed cell problem with five regions of differing material properties, source strengths and boundary conditions. The strongly varying flux distribution over the slab provides a demanding test case for transport codes. The geometry layout, material parameters and a plot of the resulting scalar flux is shown in Fig. 1 below. Investigate the numerical solution with different mesh refinement in each region to get results that are visually similar to that given in the figure. For reference, the maximum flux is 1.97.

   - Quadrature order $N = 10$
   - Source iteration tolerance $\epsilon = 10^{-6}$
   - $\alpha = 0.0, 0.5$ (step and diamond differencing)
   - Left boundary is reflective: albedo coefficient $\gamma = 1$, right boundary is vacuum

   If necessary, vary the quadature order of the S_N scheme.

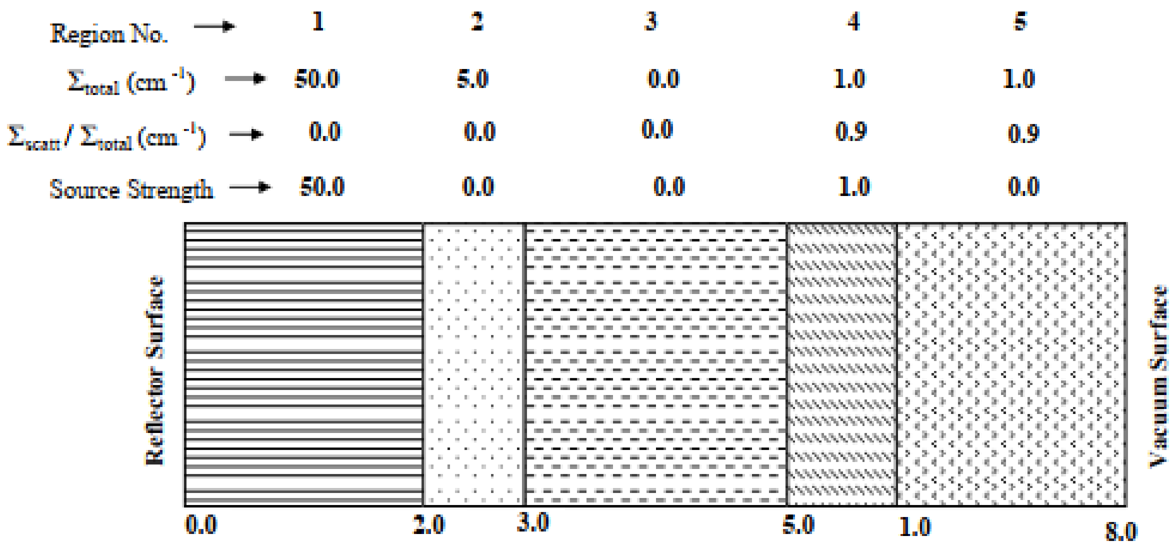

Fig. 11: Geometry of the REED Cell Problem

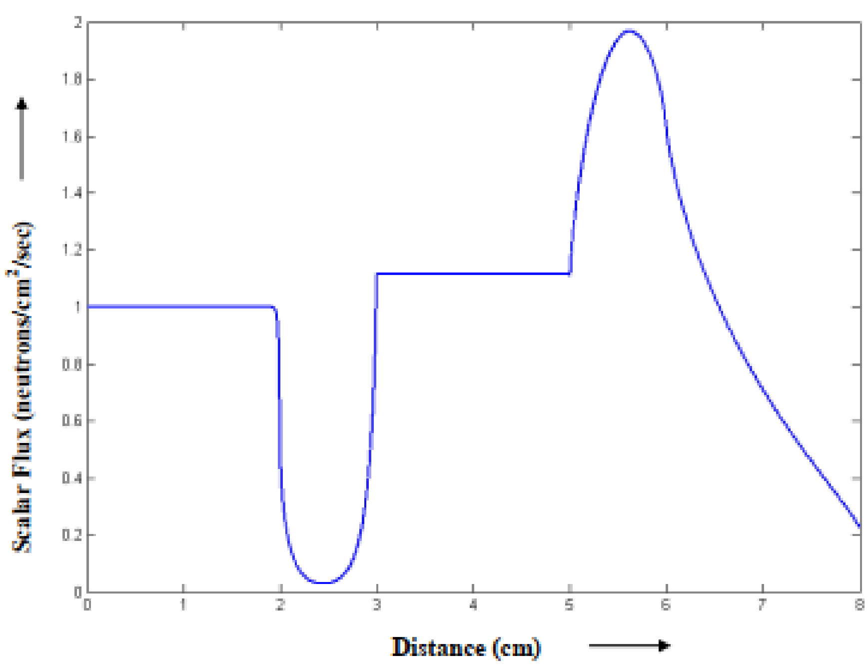

Fig. 12: Variation of Scalar Flux for REED Cell Benchmark

Figure 1: Reed Cell Problem