NE 583 Radiation Transport Methods

Test#2

Due by Midnight Nov. 18, 2018

Please work the following problems **independently**. (This means get no help from anyone but the instructor.) E-mail your results to me by the deadline.

1. Find the microscopic absorption cross section for U238 for an energy group that spans from 6 eV to 7 eV for the following mixtures:
   a. 100% U238
   b. 50/50 split (by atom) of H and U238
   c. infinitely dilute U238 in hydrogen

   Assumptions:
   a. Flux spectrum can be approximated by $1/E\sigma_t(E)$, where $\sigma_t(E)$ denotes the macroscopic total cross section.
   b. Hydrogen has a total cross section of 20 barns (all scattering).
   c. U238 has a scattering cross section of 5 barns and an absorption resonance approximated by the "chapeau" equation:

$$\tilde{\sigma}_a(E) = \begin{cases} 0 \text{ for } E < 6.52 \text{ or } E > 6.62 \\ 160000 \times (E - 6.52) \text{ for } 6.52 < E < 6.57 \\ 160000 \times (6.62 - E) \text{ for } 6.57 < E < 6.62 \end{cases}$$

   (This resonance is the only absorption in the group.)

2. For the group boundaries given in Problem #1, find the within-group microscopic elastic scattering cross section for hydrogen (A=1). Assume a 1/E flux spectrum. (Hint: It will NOT be 20 barns because not all of the scattered neutrons will stay in the group.)

3. Find the weights and mu values for an S_{14} 1D quadrature.

4. Duplicate the Table 4-1 S_8 level symmetric 3D quadrature (direction cosines and weights for the first octant). Keep in mind that the text's weights are 8 times too big.

5. Use the text's Table 4-1 S_4 quadrature to estimate the leakage shape across the top of a 6 mfp x 6 mfp 2D (x,y) pure absorption problem with an isotropic unit source (1 particle per square mfp) in the lower-left 1 mfp x 1 mfp corner.