NUCL 510 HMWK 6

1. Angular Flux in Slab Geometry
   1. Scalar Flux
   2. Partial Currents
   3. Angular Flux in Terms of Scalar Flux and Current
   4. Scalar Flux and Current in Terms of Partial Currents
2. One Group Integral Transport Equation

Both fluxes show contributions from two regions. The first term in each equation shows the contribution from the scattering of the source neutrons in the inner area. The second term in each equation shows the contribution from scattering in the outer shell.

1. Iterative Computational Procedure for Finding Flux
   1. Calculation of First Iterate using

For First iterate, we assume there is a linear approximation of the flux:

* 1. Plot of First Iterate

See plot below (including diffusion equation solution).

* 1. Qualitatively between iterate stages

Through iteration, the solution found for this equation is an order polynomial. It is constant for the 0th iterate, a linear function for the 1st iterate, a parabola for the 2nd iterate. Although we can increase the order to infinity, we will never reach the true answer, since the true answer is a Bessel function. The approximation will converge towards, but never reach the true distribution of flux.

* 1. Solve one group diffusion for this case; plot and compare results

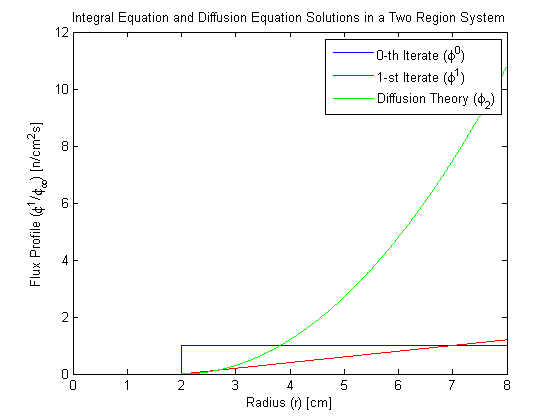


Figure Flux Profile Over Radius

The chart above shows how the approximations start to come closer to the approximation given by diffusion theory. They will converge as the iteration increases.

1. Separation of Energy and Spatial Variables
   1. Material Buckling

To solve for material buckling, follow mathematical steps as shown:

Assuming no scattering because of one Energy group, is unneeded because all fission neutrons are born into the energy group (since there is only one)

* 1. Find k=1/ for

Using the value for a, the geometric buckling must be solved. Then, the lambda-mode material buckling is set equal to that solution. From there, can be solved for, and used to calculate k.

* 1. Find the critical dimension

In this case, the fundamental lambda mode solution () is used. Material buckling is set equal to geometric buckling and solved for.

* 1. Increase the critical dimension and find absorption needed to make critical.

After increasing critical dimension and finding the geometric buckling, set equal to material buckling and solve for absorption cross section.

(a small increase in absorption will make this critical again)

* 1. Modify composition so

Lambda mode solutions are basically increasing because of their multiplication. For this case, lambda mode solution is found corresponding to k=1.05, then the material buckling is set equal to geometric buckling. The product of is equal to the new composition .

(a small decrease in fission source will make this configuration critical again)