NUCL610 Project 1

Diffusion Finite Difference

Part A, Develop a one dimensional (slab) finite difference code for steady state neutronic diffusion theory.

Part B, Apply your code to a homogeneous model with 100cm thickness which are divided into 5 regions with 20cm each. The boundary conditions are reflective on the left boundary and vacuum on the right boundary. Test your code with 2 cases with material UO2 and MOX respectively which 2 group cross sections are given in following table.

Case 1

Vacuum

Reflective

UO2

UO2

UO2

UO2

UO2

Case 2

Vacuum

Reflective

MOX

MOX

MOX

MOX

MOX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **material** | **g** |  |  |  |  |
| UO2 | 1 | 8.873837e-3 | 5.424022e-3 | 2.332139e-1 | 1.592122e-2 |
|  | 2 | 6.377025e-2 | 9.959442e-2 | 8.918111e-1 | 0 |
| MOX | 1 | 1.406811e-2 | 1.126274e-2 | 2.219159e-1 | 1.147102e-2 |
|  | 2 | 2.691350e-1 | 4.577393e-1 | 1.043375e+0 | 0 |

Compare your solution with analytical solution, refine the mesh size until the k-eff difference is within 1pcm and differences of average fluxes in 5 regions are within 1%.

Part C, Apply your code to following heterogenous model with 5 material region using materials in given in Part B. The thickness of each material regions is 20 cm. Doubling number of meshes until the k-eff difference between two finest meshing cases is within 1pcm, and differences in material region average fluxes are within 1%.

Vacuum

Reflective

UO2

MOX

UO2

MOX

UO2