3. Find the solution to the diffusion equation for 1-group, slab geometry, where the material is a pure scatter and the slab width is X:

The one group, slab geometry diffusion equation for slab geometry is:

Has a solution of the form:

x=-a/2

x=a/2

x=0

General boundary condition:

Where:

And:

Applied at right side:

Applied at left side:

Plug in

Solve for

Using the provided constants:

|  |  |  |  |
| --- | --- | --- | --- |
|  | A | B | C |
| Vacuum Marshak | 0.25 | 0.5 | 0 |
| Vacuum Mark | 0.5 | 0.866025 | 0 |
| Vacuum Dirichlet | 1 | 0 | G |
| Reflecting | 0 | 1 | 0 |
| Albedo | (1-α)/(2(1+α)) | 1 | 0 |

1. Vacuum Marshak Conditions:

(plots assumed )



1. Vacuum Mark Conditions:



1. Vacuum Dirichlet Conditions
   1. C=0.5



1. Vacuum Dirichlet conditions on the left and albedo on the right

CL=0.5. Albedo varied from 0 to 1



1. Vacuum Dirichlet condition on the left and reflecting on the right



The albedo condition can represent either a reflecting or vacuum condition. Extrapolation distances were consistent with expectations.

Code for plotting reproduced below:

D=1;a=1;q=1;alpha=0.999;

%Boundary Conditions:

CL=0.5;CR=0;BL=0;BR=1;AL=1;AR=(1-alpha)/(2\*(1+alpha));

%Plot Solution

C1=((AL/AR)\*(CR+q\*a\*BR)-BL\*q\*a-CL)/(a\*AL+(AL\*BR\*D)/AR+BL\*D);

C2=CR/AR+((q\*a\*BR)/AR+(q\*(a^2))/(D\*4))-C1\*(a/2+(BR\*D)/AR);

x=linspace(-0.8,0.8);

phi=(-q./D).\*(x.^2)+C1.\*(x)+C2;

plot(x,phi,'r','LineWidth',2);

%Plot Bars

hold on

y=linspace(0,1.7);

xn=ones(1,100).\*-0.5;xp=ones(1,100).\*0.5;

plot(xn,y,'b','LineWidth',3);

plot(xp,y,'b','LineWidth',3);

grid on;xlabel 'X';ylabel '\phi';

legend ('\phi Dirichlet Left Reflecting Right','Boundaries');

ylim([0,0.8]);