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% Matlab Program: Concentration Diffusion in one dimensional and radius
% Implicit Method
clear;
clc;

% Parameters to define the heat equation and the range in space and time
H=35; % Height of the reactor
r=1; % Final radius

% Parameters needed to solve the equation within the fully implicit method
maxr = 48; % Number of radius steps
dr=r/maxr;
n=15; % Number of space steps
dz=H/n;

dif=9.1e-6; % Diffuvisity
vz=25; %Velocity
Rph=-3.3e-7;%-6.6e-7;   %-1.54e-9; %Phenol oxidation rate
b = (dif*dz)/(vz);
G = (Rph*dz)/(vz);
%c(z,r)=c(i,k)

% Radial concentration in the reactor (r=R)
    for i=1:n+1
      z(i)=(i-1)*dz;

%c(1,k)=50
    end
% Concentration at the boundary (C=0,L)
for k=1:maxr+1
    % c(1,k)=0
     c(n+1,k)=500;
    % c(i,1)=0;
    % c(i,maxr+1)=0;

    %c(i,maxr)=0;
     c(i,1)=0;

     %c(i-1,k)=c(i,k)*dr;
    Rad(k)=(k-1)*dr;
    %c(i,maxr)=0;
    %c(i,k+1)=c(i,k);
        %c(n+1,k)=c(1,k)*dr;
end



% Implementation of the explicit method

for k=1:maxr % Radial Loop
for i=2:n % Height Loop
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c(i,k+1)=c(i,k) + G + (b*(((c(i+1,k)-c(i,k)))/dr))*((1/6)+ (((c(i+1,k)-c(i,k)))/dr));
end
end

%conc1=zeros(size(Rad))
%conc2=zeros(size(z))
%conc=conc1+conc2'
mesh(z,Rad,c')
xlabel('Height (cm)')
ylabel('Radius (cm)')
zlabel('Concentration (ppm)')
```