```
function ThreePhaseSegregationRemixing
% ThreePhaseSegregationRemixing
% This program solves the steady three component segregation remixing
% equations for a homogeneous inflow and no flux boundary conditions.
% The velocity field u has an exponential dependence on z and the large,
% small and medium particles are denoted phiL=phi(1), phiS=phi(2), phiM.
% The problem is coded in subfunctions PDEX1PDE, PDEX1IC, and PDEX1BC.
%
global SLS SLM SMS Dr phis0 phil0 beta
%
beta  = 3.3;   Dr    = 0.03;
SLS   = 1.0;   SLM   = 0.8;   SMS   = 0.5;
phil0 = 1/2;   phis0 = 1/6;   phim0 = 1-phis0-phil0;
zpts  = 200;   xpts  = 200;   xmax  = 2.1;
%
% set up grid and call the libraries to solve the PDEs
%
z       = linspace(0,1,zpts);
x       = linspace(0,xmax,xpts);
options = odeset('RelTol',1e-6);
sol     = pdepe(0,@pdex1pde,@pdex1ic,@pdex1bc,z,x,options);
%
% extract concentrations and calculate concentration medium sized grains
%
phiL = sol(:,:,1);   phiS = sol(:,:,2);  phiM = 1-phiL-phiS;
%
% plot the results
%
subplot(311); contourf(x,z,phiL');
subplot(312); contourf(x,z,phiM');
subplot(313); contourf(x,z,phiS');

function [c,f,s] = pdex1pde(z,x,phi,DphiDz)
global SLS SLM SMS Dr beta
c = [beta*exp(beta*z)./(exp(beta)-1); beta*exp(beta*z)./(exp(beta)-1)];
f = [-SLM*phi(1)*(1-phi(1)-phi(2))-SLS*phi(1)*phi(2)+Dr*DphiDz(1);
     +SLS*phi(1)*phi(2)+SMS*phi(2)*(1-phi(1)-phi(2))+Dr*DphiDz(2)];
s = [0; 0];

function u0 = pdex1ic(z)
global phil0 phis0
u0=[phil0; phis0];

function [ptop,qtop,pbtm,qbtm] = pdex1bc(ztop,phitop,zbtm,phibtm,x)
ptop = [0; 0];
qtop = [1; 1];
pbtm = [0; 0];
qbtm = [1; 1];
```