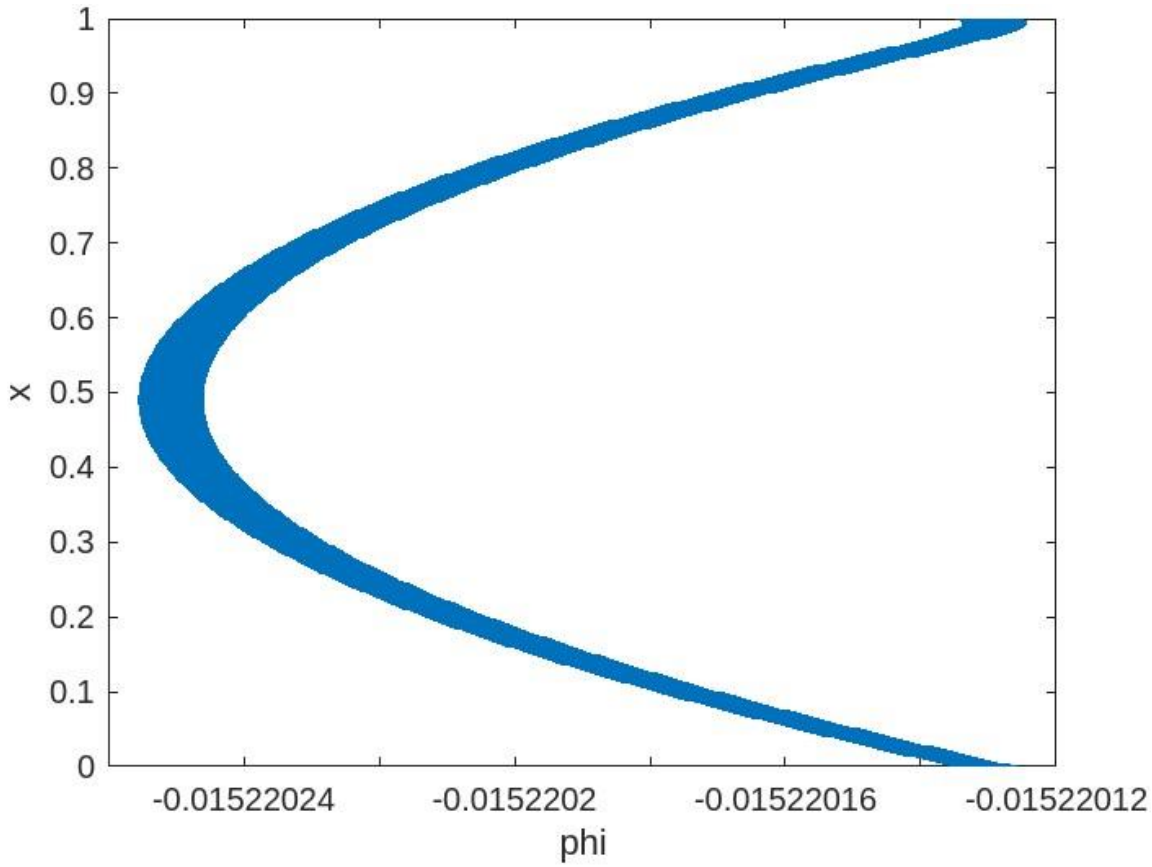
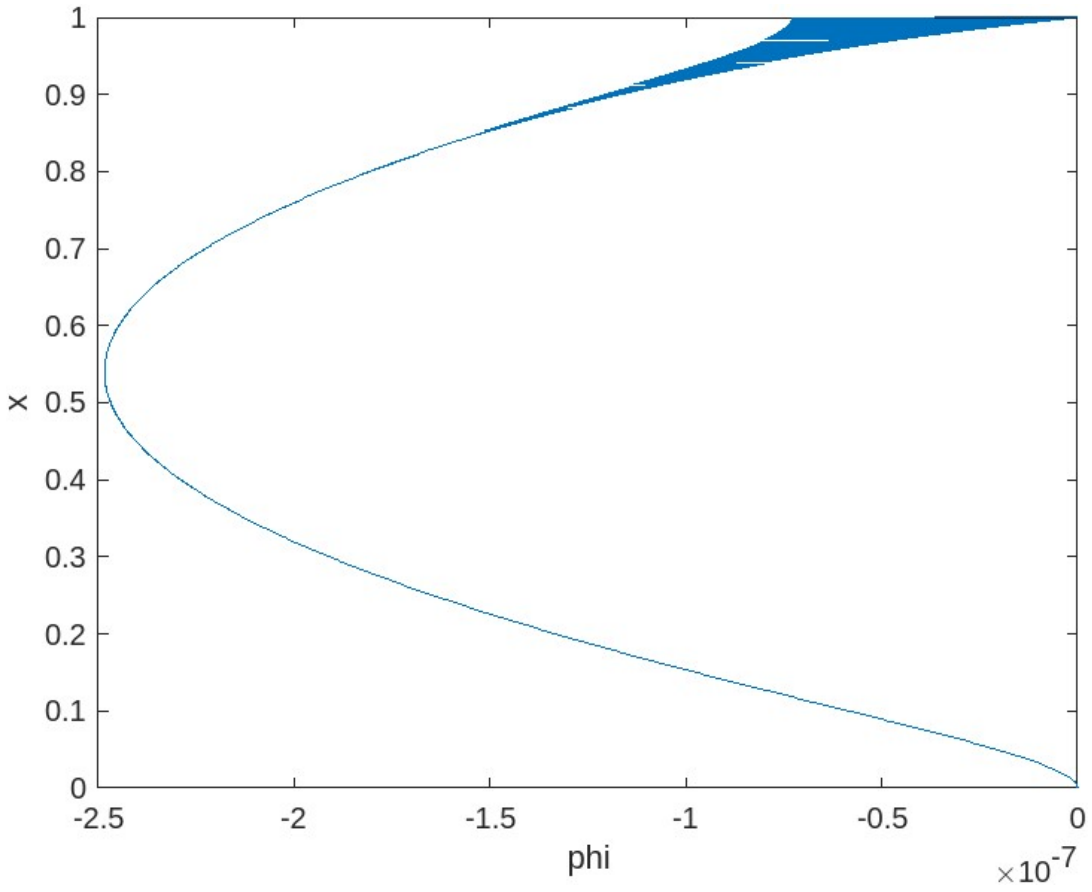
1-D Steady State Convection Diffusion with Porous Medium MATLAB Code:

```
% define variables
L=1; % length of rod
n=101; % number of grid points
dx=L/(n-1); % Grid spacing
x=linspace(0,L,n); % Grid points
density=19300; % Density of material
u=1; % Velocity of particle
gamma=0.5; % coefficient
mu=4.84
k=318

S=x.*(x-1);  % define the source term

% define the initial condition
phi=zeros(1,n);
phi=x.^2;

% define the matrix for the finite difference method
A=zeros(n,n);
A(1,1) = 1;
for i = 2:n-1
    A(i,i-1) = +density*u/(2*dx) + gamma/dx^2;
    A(i,i) = 2*gamma/dx^2;
    A(i,i+1) = -density*u/(2*dx) + gamma/dx^2;
end
A(n,n)=1;

% solve for the steady state solution
phi=A\S'-mu*u/k;

% plot the graph
plot(phi,x);
xlabel('phi');
ylabel('x');
```


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
x
-0.01522024
-0.0152202
-0.01522016
-0.01522012
phi

1-D Steady State Convection Diffusion without Porous Medium MATLAB Code:

```
% define variables
L=1; % length of rod
n=1001; % number of grid points
dx=L/(n-1); % Grid spacing
x=linspace(0,L,n); % Grid points
density=19300; % Density of material
u=1; % Velocity of particle
gamma=0.5; % coefficient
S=x.*(x-1); % define the source term

% define the initial condition
phi=zeros(1,n);
phi=x.^2;

% define the matrix for the finite difference method
A=zeros(n,n);
A(1,1) = 1;
for i = 2:n-1
    A(i,i-1) = -density*u/dx - gamma/dx^2;
    A(i,i) = 2*gamma/dx^2;
    A(i,i+1) = density*u/dx + gamma/dx^2;
end
A(n,n)=1;

% solve for the steady state solution
phi=A\S';

% plot the graph
plot(phi,x);
xlabel('phi');
ylabel('x');
```


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
x
-2.5
-2
-1.5
-1
-0.5
0
phi
×10-7