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%HW2-Prb1
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clc       %clear screen
clear all % clearing all stored variables
close all %close previous plots

k = [0.1,0.2,0.1,0.8]; %sec^-1
V = 10; %Litres
v = 1 ; %L/sec
feed = [5,0,0,1]'; %M, feed concentrations

t = V/v; %sec
A = zeros(4,4); %initializing A matrix.

A(1,:) = [1+k(1)*t, 0, 0, 0];
A(2,:) = [-k(1)*t, 1 + (k(2)+k(4))*t, 0, -k(3)*t];
A(3,:) = [0, -k(4)*t, 1, 0];
A(4,:) = [0, -k(2)*t, 0, 1+ k(3)*t];

%Doing LU decomposition on A matrix.
[L,U,P] = lu(A);

% Our problem was Ax = feed. After decomposing into LU, our problem
 became
% LUx = feed which can be solved in two steps. Let Ux = b, then our
 problem
%becomes Lb = feed. b = L^-1 * feed. Then we have to solve Ux = b.

fprintf('Vector formed as a result of the first multiplication of a
 triangular matrix by the feed vector:')
f1 = P*feed; %matlab pivot elements while calcultaing LU, so
 multiplying by permutation matrix is necessary to get right results.
b = L\(f1)

fprintf('Steady State Reactor Concentrations are:')
c_ss = U\b %Caculating results

Vector formed as a result of the first multiplication of a triangular
 matrix by the feed vector:
b =

    5.0000
    2.5000
    1.8182
    1.4545

Steady State Reactor Concentrations are:
c_ss =

    2.5000
    0.3000
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    2.4000
    0.8000
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