Rendezvous Problem

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AIM

To have the robots meet at the same location

PROCEDURE

Taking two robots into consideration

Let two robots be in position x1 and x2

We can control the velocities say u1 and u2

So u1=(x2-x1)/dt   u2=(x1-x2)/dt

[u1 , u2]'=[-1,1;1,-1]*[x1 , x2]'

So input state parameters x=[x1 , x2]'

Control parameters=[u1,u2]'

Output state parameter is also position y=[x1 , x2]'

<x1>--<x2>

A=[-1 , 1;1 , -1]

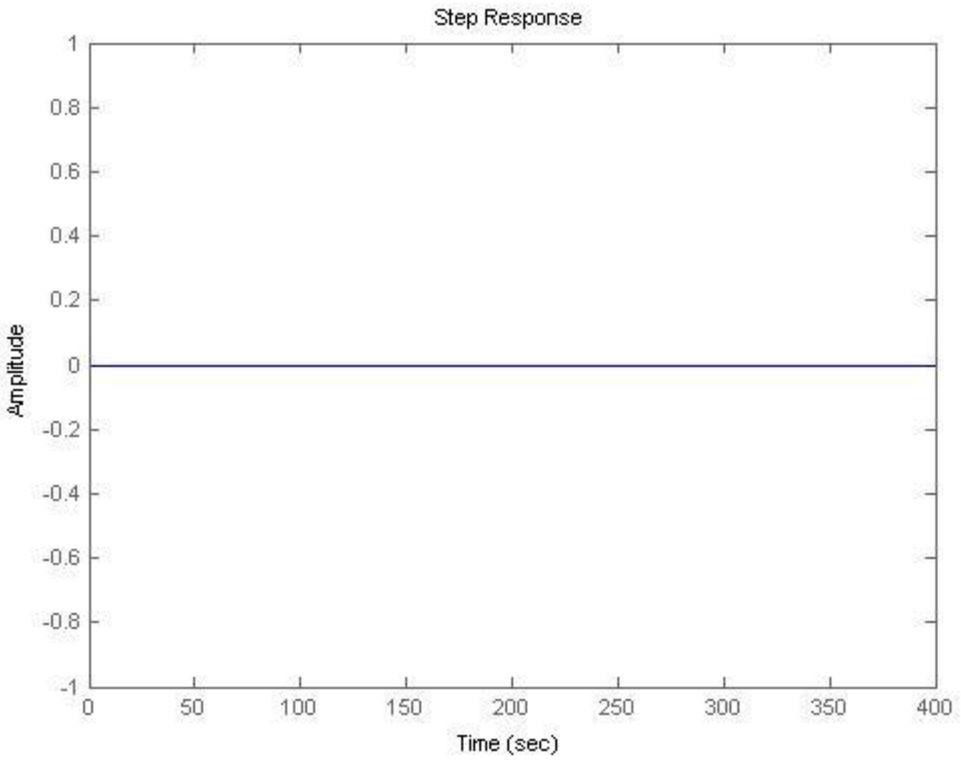
B=[0,0]'

C=[1 , 1]

D=0

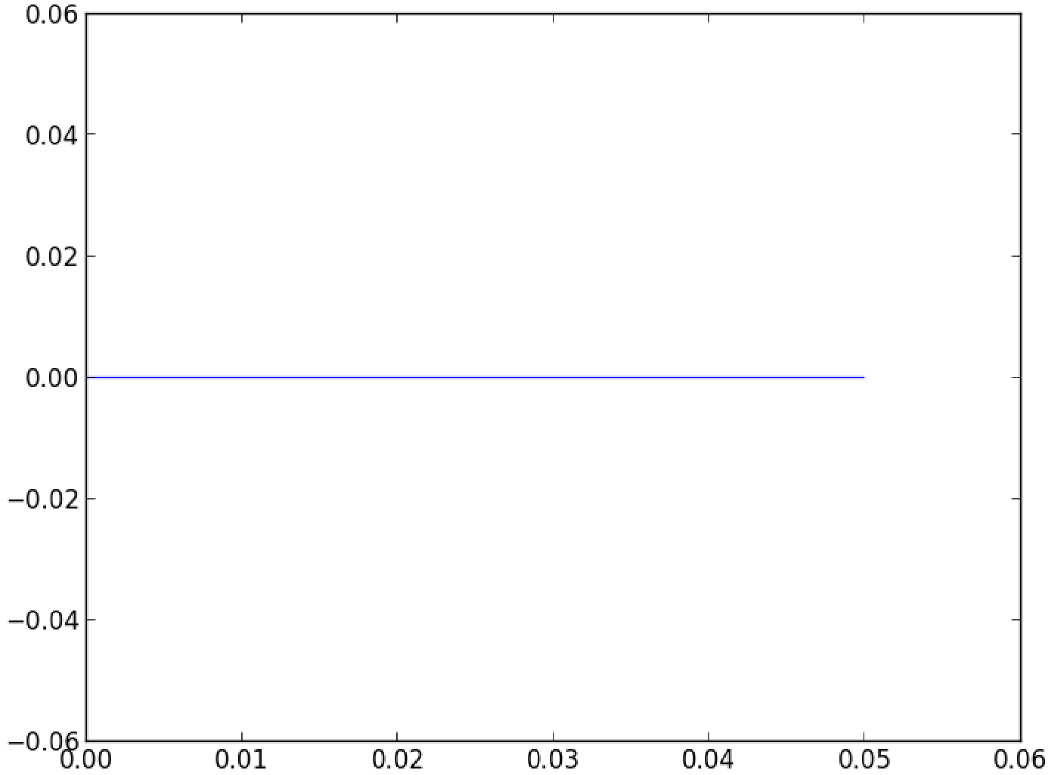
```
function rendezvous
A=[-1 1;1 -1];
B=[0;0];
C=[1,1];
D=0;
ran=ss(A,B,C,D);
[eig_vec,eig_val]=eig(A)
step(ran)
%[resp,t]=impulse(ran);
%plot(t,resp)
end

eig_vec =

    0.7071    0.7071
   -0.7071    0.7071
```

```
eig_val =

    -2     0
     0     0
```



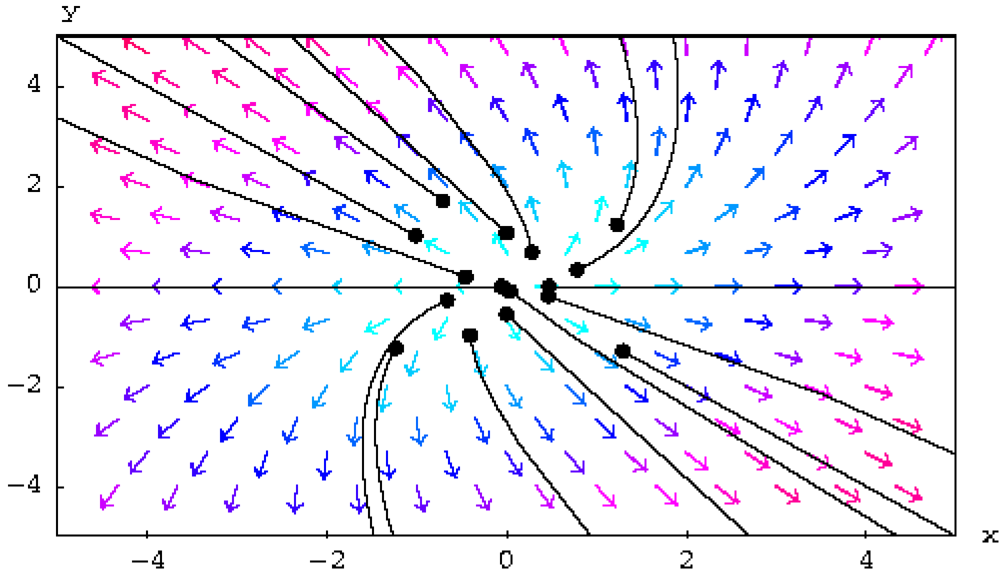

```
#!/usr/bin/env python

from numpy import *
from scipy import *
from pylab import *
from scipy.integrate import odeint
from scipy.signal import lti,step
from matplotlib import pyplot as plt
from control import *


# THIS IS THE ORIGINAL PROGRAM. DO NOT CHANGE ANYTHING


A=([-1,1],[1,-1])
B=([0],[0])
C=[1,1]
D=0
sys_plant=ss(A,B,C,D)
w,v=eig(A)
#Tt=input('total_time')
#n=input('number_of_steps')
t=r_[0:0.05:100j]
T,yout=step_response(1*sys_plant,t)
yout,T=impulse(sys_plant,t)
plt.plot(T,yout)
```

```
plt.show()
```



from the Eigen value computation we see that
$\lambda 1=-2$ and $\lambda 2=0$
we see that system has one zero Eigen value so the system is critically stable and hence we calculate the Eigenvector and see that Eigen vector corresponding to $\lambda 2=0$ is 0.71,0.71 which implies that both robots reach the rendezvous location

for many robot the equation will be
$x(i)=\sum_{(1,j,n)}(x(j)-x(i))$
and A=[-(n-1),1,1….;1,-(n-1),1,1….;1,1,…..,-(n-1)]
and when solved for Eigen value one of the value is zero so the system is critically stable and hence will reach the same location that is the centroid of the system.



y
4
2
0
−2
−4
−4
−2
0
2
4
x