**INSTITUTO TECNOLÓGICO Y DE ESTUDIOS SUPERIORES**
**CAMPUS QUERÉTARO**

# Homework 4: Dynamics 2DOF Planar Robot

**Applied Robotics**

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August - December 2022

Dynamical Equations:

$$x_1^* = x_2$$

$$x_2^* = f_2(x) + g_{21}(x)t_1 + g_{22}(x)t_2$$

$$x_3^* = x_4$$

$$x_4^* = f_4(x) + g_{41}(x)t_1 + g_{42}(x)t_2$$

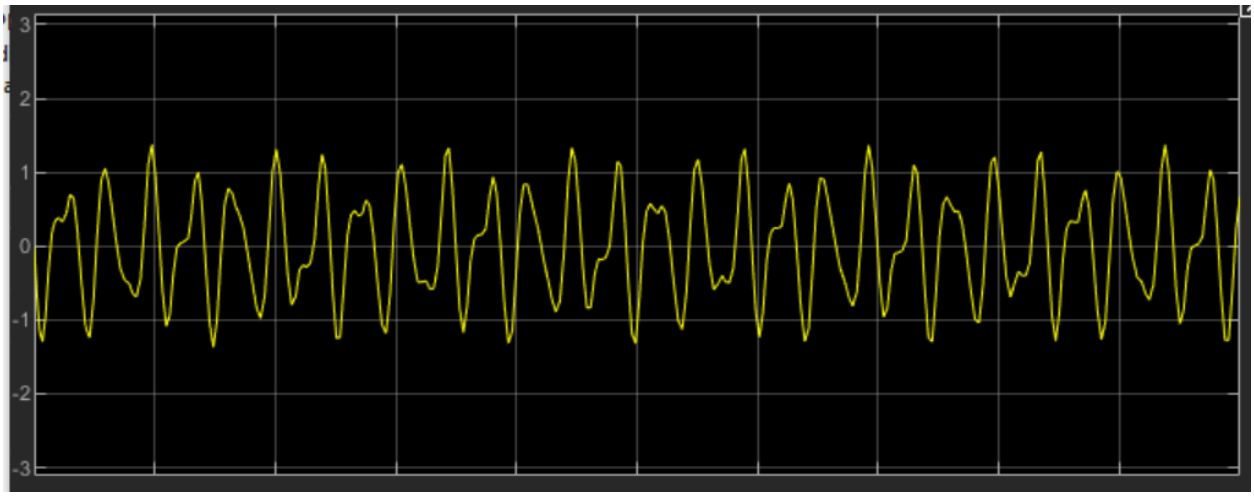
MATLAB Solution:

```
function ddq = robot(dq,q,tau)


l1=0.5;

l2=l1;

m1=6;

m2=2;

g=9.81;

b1=0;

b2=0;


%Inertia matrix terms

m11= m2*l2^2 + (m1+m2)*l1^2 + 2*l1*l2*m2*cos(q(2));

m12= m2*l2*(l2 + l1*cos(q(2)));

m21= m2*l2^2 + l1*l2*m2*cos(q(2));

m22= m2*l2^2;

%Centripetal and Coriolis forces matrix terms

c1= -2*m2*l1*l2*dq(1)*dq(2)-m2*l1*l2*dq(2)^2*sin(q(2));

c2= m2*l1*l2*dq(1)^2*sin(q(2));

%Gravity matrix terms

g1= m1*g*l1*sin(q(1)) + m2*g*(l1*sin(q(1)) + l2*sin(q(1)+q(2)));

g2= m2*g*l2*sin(q(1)+q(2));

%Friction matrix terms

f1=b1*dq(1);
```

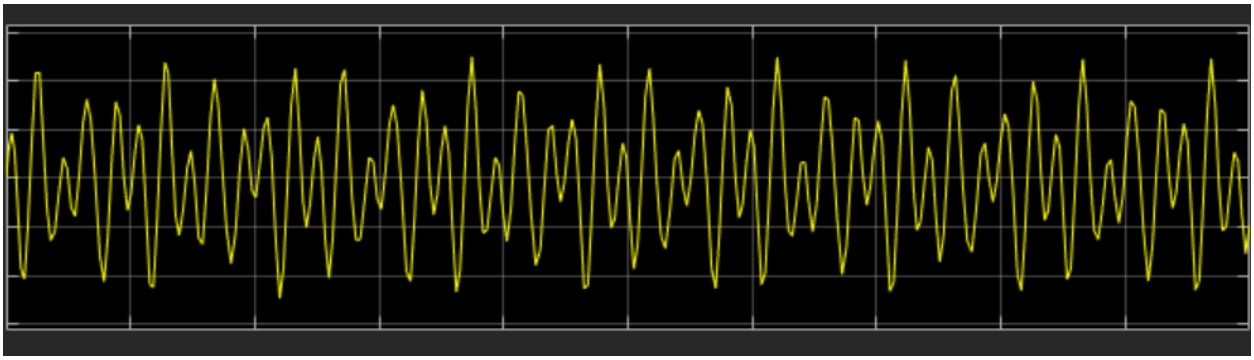
```
f2=b2*dq(2);
%Matrices
M=[m11, m12; m21, m22];
C=[c1; c2];
G=[g1; g2];
F=[f1; f2];
ddq= - inv(M)*(C + G + F - tau);
```

Positions and Velocities for Tao[0] = 0.1*Pi and Tao[1] = 0

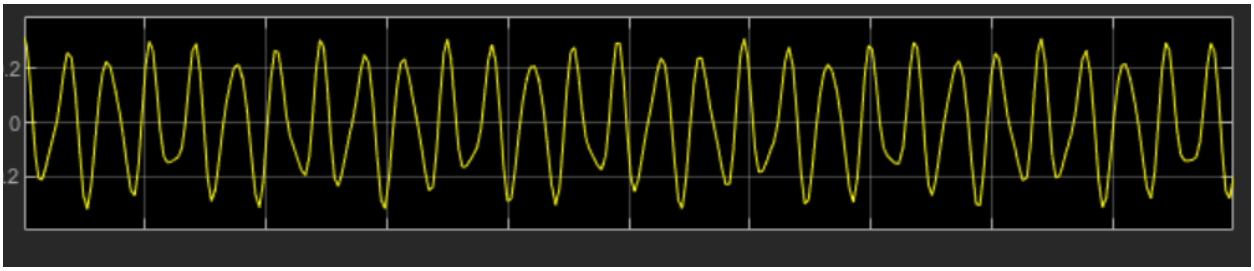
Dq1:



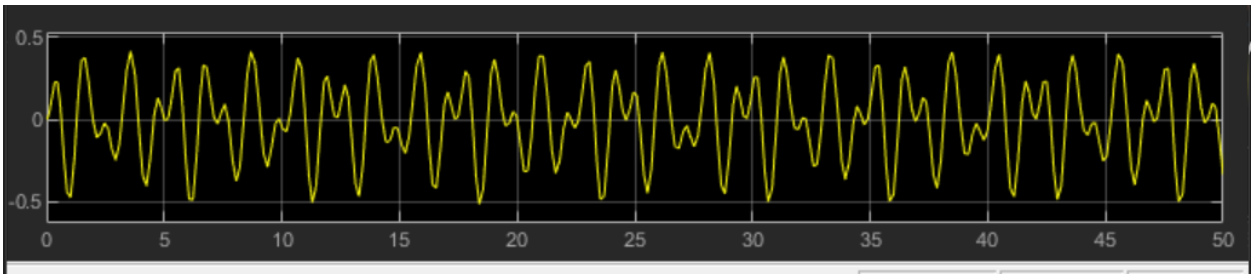

Dq2:



Q1:



Q2:




Conclusions:

Albeit this activity was solved using MATLAB and Simulink I found it very interesting and important, because I not only obtained the equations needed to model the 2 DOF robot, but I also found the importance of numerical approaches to differential equations that are almost, if not impossible to solve using normal methods. The good news is that MATLAB and Simulink can handle all of that with ease.