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```
function HW2_LiamHood()
```

Aero 421 HW2

Liam Hood

```
clear; close all; clc;
```

12.1

Attitude

```
roll = pi/4 ;
pitch = pi/4 ;
yaw = pi/4 ;
[ CbG ] = C_321Euler( roll , pitch , yaw ) ;

% position
Ro = 7000e3 ; % m
Ro_G = [ 0 , 0 , Ro ]' ; % ECI
Ro_b = CbG*Ro_G ; % body
Rbcross = crossmatrix( Ro_b ) ;

% Inertia
Ip = zeros( 3,3 ) ; % kg*m^2
Ip(1,1) = 100 ;
Ip(2,2) = 120 ;
Ip(3,3) = 80 ;

mue = 398600 ; % km^3/s^2
mu = 398600*(1000)^3 ; % m^3/s^2

Tgg = (( 3*mu )/( Ro^5 ))*Rbcross*Ip*Ro_b ;
disp( 'The gravity gradient torque in the body frame in N*m is' )
disp( Tgg )
```

```
The gravity gradient torque in the body frame in N*m is
   1.0e-03 *

   -0.0349
   -0.0247
```

0.2278

13.1

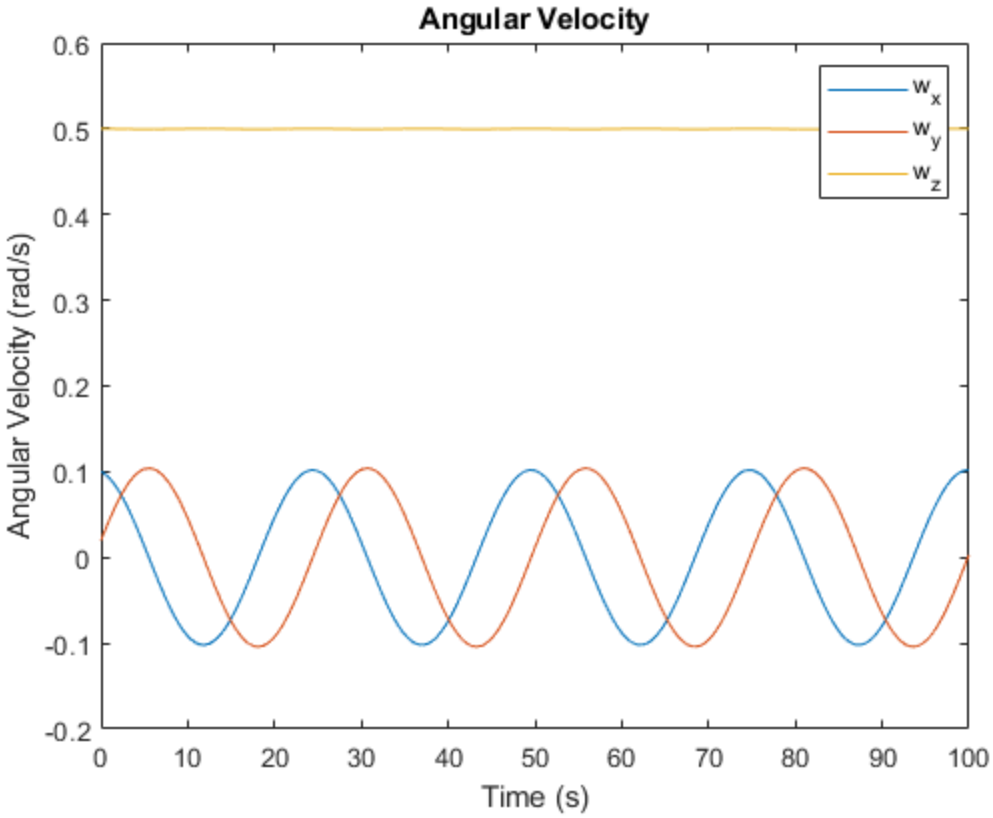
```
I = PrincipalMoI( 98 , 102 , 150 ) ; % kg*m^2
w0 = [ .1 , .02 , .5 ] ; % rad/s
opts = odeset( 'RelTol' , 1e-10 , 'AbsTol' , 1e-10 ) ;
[ t , w ] = ode45( @TorqueFree , [ 0 , 1e2 ] , w0 , opts , I ) ;
figure
plot( t , w(:,1) , t , w(:,2) , t , w(:,3) )
title( 'Angular Velocity' )
xlabel( 'Time (s)' )
ylabel( 'Angular Velocity (rad/s)' )
legend( 'w_x' , 'w_y' , 'w_z' )
disp( 'Angular velocity in z is constant and the others oscillate.
 Both of ' )
disp( 'the transverse velocities have the same amplitude which is ' )
disp( 'because I didn''t require the s/c to be axisymmetric yet. ' )
disp( ' ' )

disp( 'I assumed axisymmetric for this part because we have only
 derived the' )
disp( 'equations for nutation and precession rate for that case ' )
hx = I(1,1) .* w(:,1) ;
hy = I(2,2) .* w(:,2) ;
hz = I(3,3) .* w(:,3) ;
ht = ( hx.^2 + hy.^2 ).^(1/2) ;
h = ( hx.^2 + hy.^2 + hz.^2 ).^(1/2) ;

nut = asin(ht./h) ;
nutation = mean( nut ) ;
disp([ 'The nutation angle is ' , num2str(nutation) , ' rad' ])
precessionrate = mean( h./( mean( I(1,1) , I(2,2) )) ) ;
disp([ 'The precession rate is ' , num2str(precessionrate) , ' rad/s'
 ])
```

```
Angular velocity in z is constant and the others oscillate. Both of
the transverse velocities have the same amplitude which is
because I didn't require the s/c to be axisymmetric yet.

I assumed axisymmetric for this part because we have only derived the
equations for nutation and precession rate for that case
The nutation angle is 0.13653 rad
The precession rate is 0.77209 rad/s
```




```
end
```

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