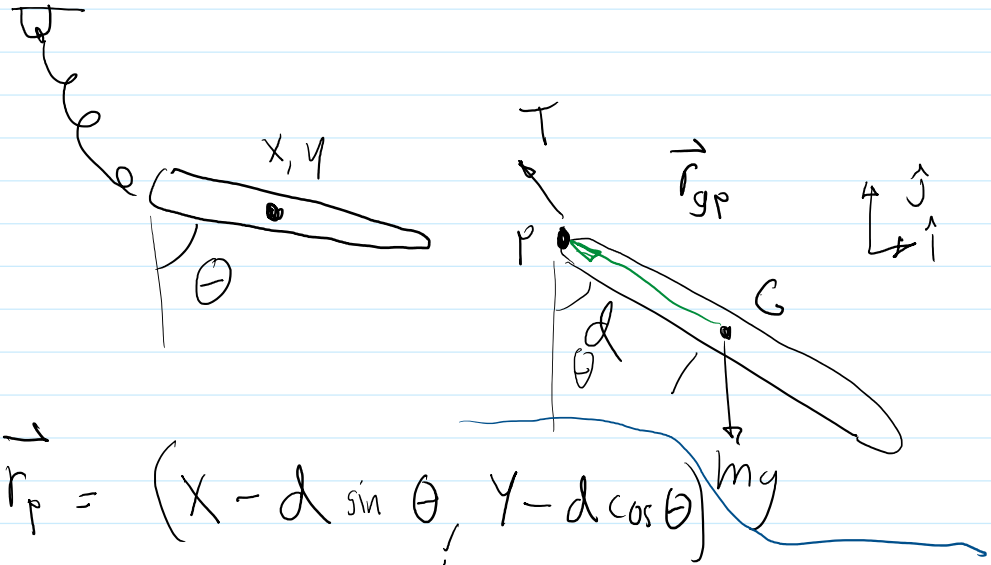
Discussion 10

Sunday, April 11, 2021 7:12 PM



$$\vec{r}_p = (X - d\sin\theta,\ Y - d\cos\theta)$$

$$\vec{F}_s = -k(\|\vec{r}_p\| - l_0)\cdot \frac{\vec{r}_p}{\|r_p\|}$$

$$\vec{T}_{app} = (-d\sin\theta, -d\cos\theta) \times \vec{F}_s$$

$$\ddot{X}\, m = \vec{F}_s \cdot \hat{i}$$

$$\ddot{y}\, m = \vec{F}_s \cdot \hat{j} - mg$$

$$\ddot{\theta}\, I_G = \vec{T}_{app}$$

There are scalar eqns

T l

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```
% A RHS file for discussion 10

function zdot=disc10rhs(t,z,p)
x=z(1);y=z(2);theta=z(3); % breakdown z
ihat=[1 0]';jhat=[0 1]'; %define unit vectors
rG=[x;y];
rGS=p.d*[-sin(theta); -cos(theta)]; % end of rod with respect to G
```

T l


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function zdot=disc10rhs(t,z,p)
x=z(1);y=z(2);theta=z(3); % breakdown z
ihat=[1 0]';jhat=[0 1]'; %define unit vectors
rG=[x;y];
rGS=p.d*[-sin(theta); -cos(theta)]; % end of rod with respect to G
rS=rG+rGS; %end of rod
magS=norm(rS);
Fs=-p.k*(magS-p.L)*rS/magS; %spring force (vector)
% Three ways to do 2d cross product
% first add a zero to each vector, use matlab cross fnctn, take third↙
component,
% or combine vectors and take detirminate.
% or do the compontent math

% using the detirminate method here
Tapp=det([rGS,magS]); %find applied torque
xddot=dot(Fs,ihat)/p.m;
yddot=dot(Fs,jhat)/p.m-g;
thetaddot=Tapp/m.I;
zdot=[z(3:6);xddot;yddot;thetaddot];

end
```