```
clear all
close all
clc

% Parameters and initial states
tf = 15;
x0 = 1;
theta0 = 0;
q = [x0; theta0];
dq = zeros(2, 1);
J = 1;
M = 10;
R = 0.25;
g = -9.81;
state = [q;dq];
parameters = [J; M; R; g];

% Simulation
try

    %%%%%% MODIFY THE CODE AS YOU SEE FIT

    [tsim,xsim] = ode45(@(t,x)BallAndBeamDynamics(x, parameters),
[0,tf],state);

catch message
    display('Your simulation failed with the following message:')
    display(message.message)
    display(' ')

    % Assign dummy time and states if simulation failed
    tf = 0.1;
    tsim = [0,tf];
    xsim = 0;
end
```

3D animation

```
DoublePlot = true;
scale = 0.25;
FS = 30;
ball_radius = 0.25;

% Create Objects
% Rail
Lrail = 2;
a = ball_radius;
vert{1} = [-Lrail,-a, 0;
           -Lrail, a, 0;
            Lrail, a, 0;
            Lrail,-a, 0];
fac{1} = [1,2,3,4];
```

```
% Sphere
[X,Y,Z] = sphere(20);
[fac{2},vert{2},c] = surf2patch(X,Y,Z);

% Animation
tic
t_disp = 0;
SimSpeed = 1;
if run_sim
while t_disp < tf/SimSpeed
    % Interpolate state
    x_disp   = interp1(tsim,xsim,SimSpeed*t_disp)';

    % Unwrap state. MODIFY
    theta = x_disp(2); % beam angle
    pos = BallPosition(x_disp, parameters);

    figid = figure(1);clf;hold on
    if DoublePlot
        subplot(1,2,1);hold on
        DrawBallAndBeam(pos, theta, vert, fac, xsim, ball_radius);
        campos(scale*[10    10     20])
        camtarget(scale*[0,0,1.5])
        camva(30)
        camproj('perspective')
        subplot(1,2,2);hold on
    end
    DrawBallAndBeam(pos, theta, vert, fac, xsim, ball_radius);
    campos(0.4*scale*[1    70     20])
    camtarget(scale*[0,0,1.5])
    camva(30)
    camproj('perspective')
    drawnow

    if t_disp == 0
        display('Hit a key to start animation')
        pause
        tic
    end
    t_disp = toc;
end
end
```

```
Undefined function or variable 'run_sim'.

Error in BallAndBeamSimulation (line 59)
if run_sim
```

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