```
clear

L = .1;      % initialize constants
m = 0.1;
k = 5000;
c = 20;
mu = 0.001;
I = m*L^2/2;  % the moment of inertia for a disc of radius L

dt = 0.0001;
n=10;

px(1) = 0;  % initialize state
py(1) = 2;
vx(1) = 0;
vy(1) = 0;
ax(1) = 0;
ay(1) = -10;
ar(1) = 10;   % angular rate in radians second

t(1) = 0;

for i=2:n+1
 t(i) = t(i - 1) + dt;

  if (py(i-1) < 0) break; endif  % check if center of ball undergound

  if (py(i - 1) > L)  % is ball in air ?

    ax(i) = 0;        % yes
    ay(i) = -10;      % vertical accel = -10
    arr = 0;          % angular accel = 0

  else                % no, ball is in contact with ground

    % the forces acting on the ball are gravity, damper, spring
    ay(i) = -10 - c*vy(i - 1) + k*(L - py(i - 1));
    Ff = mu*k*(L - py(i - 1));  % calculate sliding friction force
    ax(i) = Ff/m;               % accel due to sliding friction
    arr = -Ff*py(i-1)/I;     % angular accel due to sliding friction
  endif

  px(i) = px(i - 1) + vx(i - 1)*dt;
  py(i) = py(i - 1) + vy(i - 1)*dt;
  vx(i) = vx(i - 1) + ax(i)*dt;
  vy(i) = vy(i - 1) + ay(i)*dt;
  ar(i) = ar(i - 1) + arr*dt;


end

plot(t, py)
```