```
clear


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

dt = 0.0001;
n=10000;

px(1) = 0;    % initialize state
py(1) = 2.5;
vx(1) = 35;
vy(1) = 0;
ax(1) = 0;
ay(1) = -10;
ar(1) = 100 * 2 * pi;      % slice = - 10, flat = 55 , kick = 100 rev/sec



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 underground

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

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

  else   % no, the vertical forces on the ball are gravity, damper, spring

    ay(i) = -10 - c*vy(i - 1) + k*(L - py(i - 1)); % vertical acceleration

    if (ar*L >= vx(i-1) + 5)   % check if spin rate of ball > horizontal velocity +
5
       Ff = mu*k*(L - py(i - 1));  % it is, friction force is positive (to the
right)
    elseif (ar*L <= vx(i-1) - 5) % check if spin rate < horizontal velocity - 5
       Ff = - mu*k*(L - py(i - 1)); % it is, friction force is negative (to the
left)
    else
       Ff = 0;   % if spin rate within +- 5 of horizontal velocity, friction force =
0
    endif
    ax(i) = Ff/m;           % x accel due to friction
    arr = -Ff*py(i-1)/I;   % angular accel due to friction
  endif



  px(i) = px(i - 1) + vx(i - 1)*dt;   % project state
  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(px, py)
```