Shadow Bot Calculations

The governing equations are :

Let the Thrust supplied by the EDF be T,

and the Weight off the bot be W, then

for **No Sliding**,

$$T \geq \frac{W}{\mu}$$

and for **No Toppling**,

$$W \leq T * \frac{x}{c}$$

where,

x is the point of application of thrust from the rear wheel of the bot,

c is the clearance of the bot with the ground.

For the bot to move ,

Motor torque,**M** required is ,

$$M \geq \frac{W * R}{2}$$

where,

R = radius of the wheel.

And also the bot should satisfy these conditions while running,

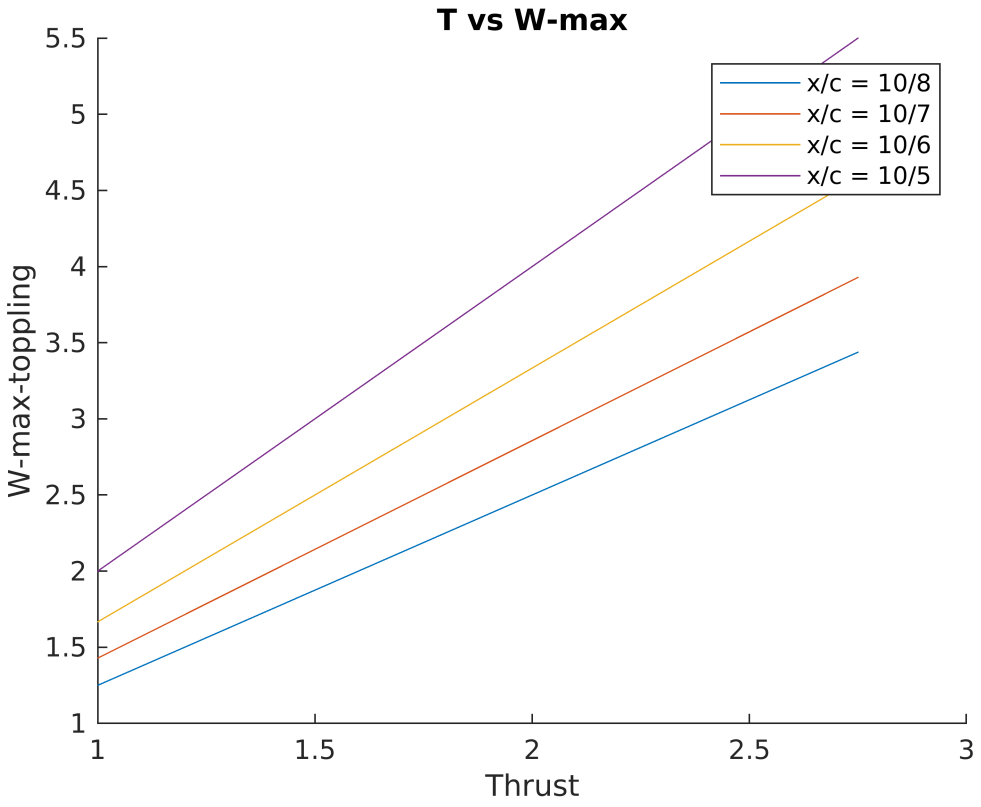
$$T \geq W * \frac{c}{x} - \frac{M}{x}$$

$$M \geq \frac{\left(\mu \frac{T}{2} - \frac{\mu W}{4} + m_0 \frac{W}{\left(\frac{W}{g} + 2m_0 \right)} \right)}{\left(\frac{m_0}{\left(Rm_0 + \frac{W}{g} \right)} - \frac{\mu}{2L} \right)}$$

which has to ensured.

Thrust vs W_max of the bot calculation for different Thrust_distance(x)/clearance of bot ratios keeping other parameters fixed :

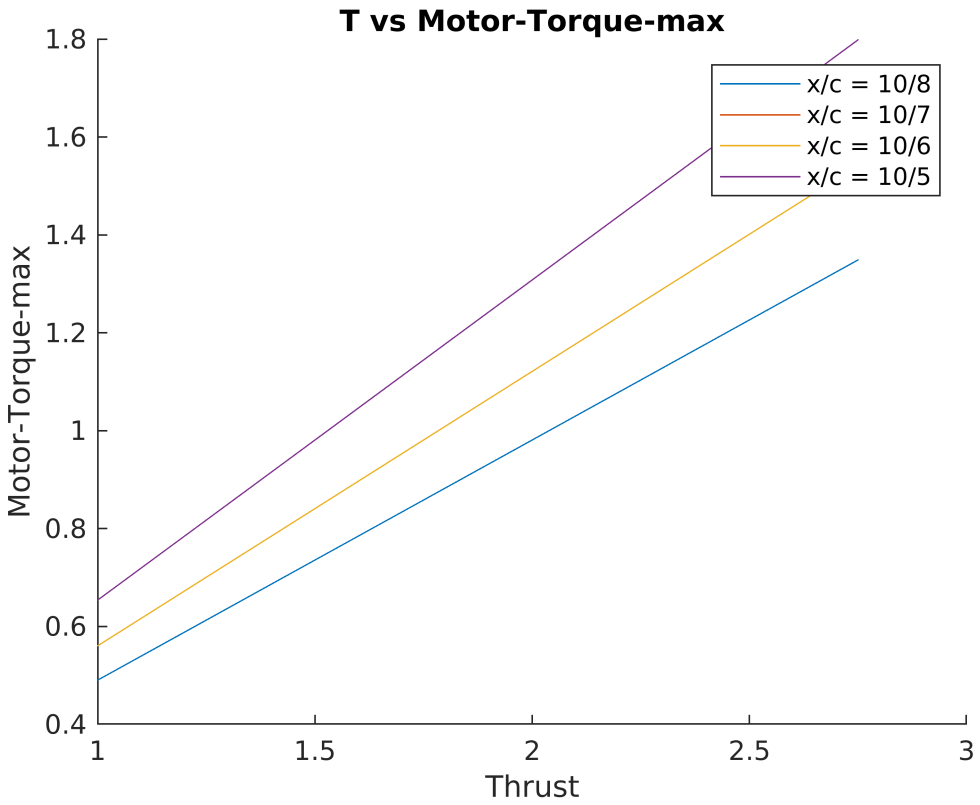
```
% Thrust vs W_max of the bot calculation for different
% Thrust_distance(x)/clearance of bot ratios keeping
% other parameters fixed
x = table2array(TvsM(13:27,2));
y = table2array(TvsM(13:27,10));
x1 = table2array(TvsM(28:42,2));
y1 = table2array(TvsM(28:42,10));
x2 = table2array(TvsM(43:57,2));
y2 = table2array(TvsM(43:57,10));
x3 = table2array(TvsM(58:72,2));
y3 = table2array(TvsM(58:72,10));
figure;
hold on;
xlabel('Thrust');
ylabel('W-max-toppling');
title('T vs W-max');
plot(x,y,x1,y1,x2,y2,x3,y3);
legend('x/c = 10/8','x/c = 10/7','x/c = 10/6','x/c = 10/5');
hold off;
```



Motor Torque vs Thrust for the same above conditions :

```
% Motor Torque vs Thrust for the same above conditions
z = table2array(TvsM(13:27,12));
```

```
z1 = table2array(TvsM(28:42,12));
z3 = table2array(TvsM(43:57,12));
z4 = table2array(TvsM(58:72,12));
figure;
hold on;
xlabel('Thrust');
ylabel('Motor-Torque-max');
title('T vs Motor-Torque-max');
plot(x,z,x1,z1,x2,z2,x3,z3);
legend('x/c = 10/8','x/c = 10/7','x/c = 10/6','x/c = 10/5');
hold off;
```



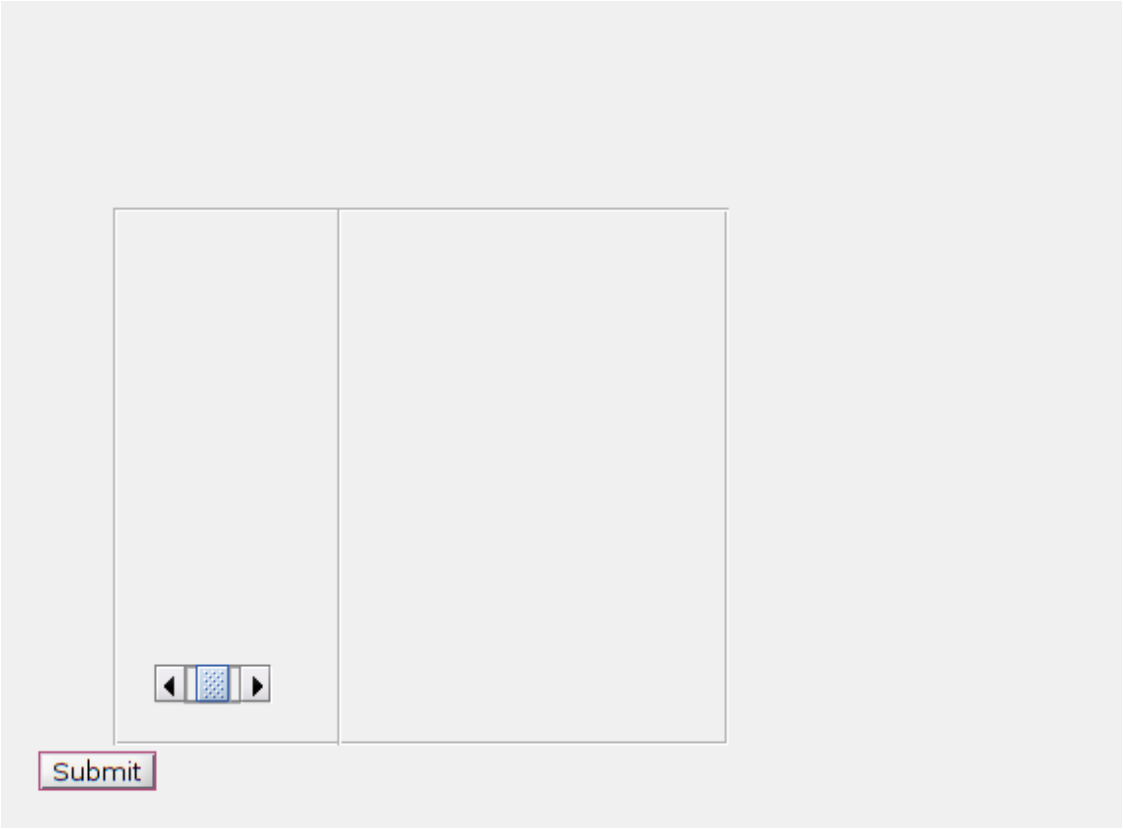
The Min Motor Torque , $M_{\min} \geq \frac{W_{\min} * R}{2}$

and $W_{\min}$ **=** $\mu * T$ **and hence depends on** μ **and T only. It does not depend on other parameters.**

To play around with the input values use of this section :

```
%{
% To Play around with the input values use this section]
Thrust = 0;
f = figure;
```

```
p = uipanel(f,'Position',[0.1 0.1 0.35 0.65]);
c = uicontrol(p,'Style','slider');
c.Value = 0.5;
p_ok = uipanel(f,'Position',[0.3 0.1 0.35 0.65]);
ok = uicontrol;
ok.String = 'Submit';
```




```
c.Callback = @pushbuttonPlot;
%}
```