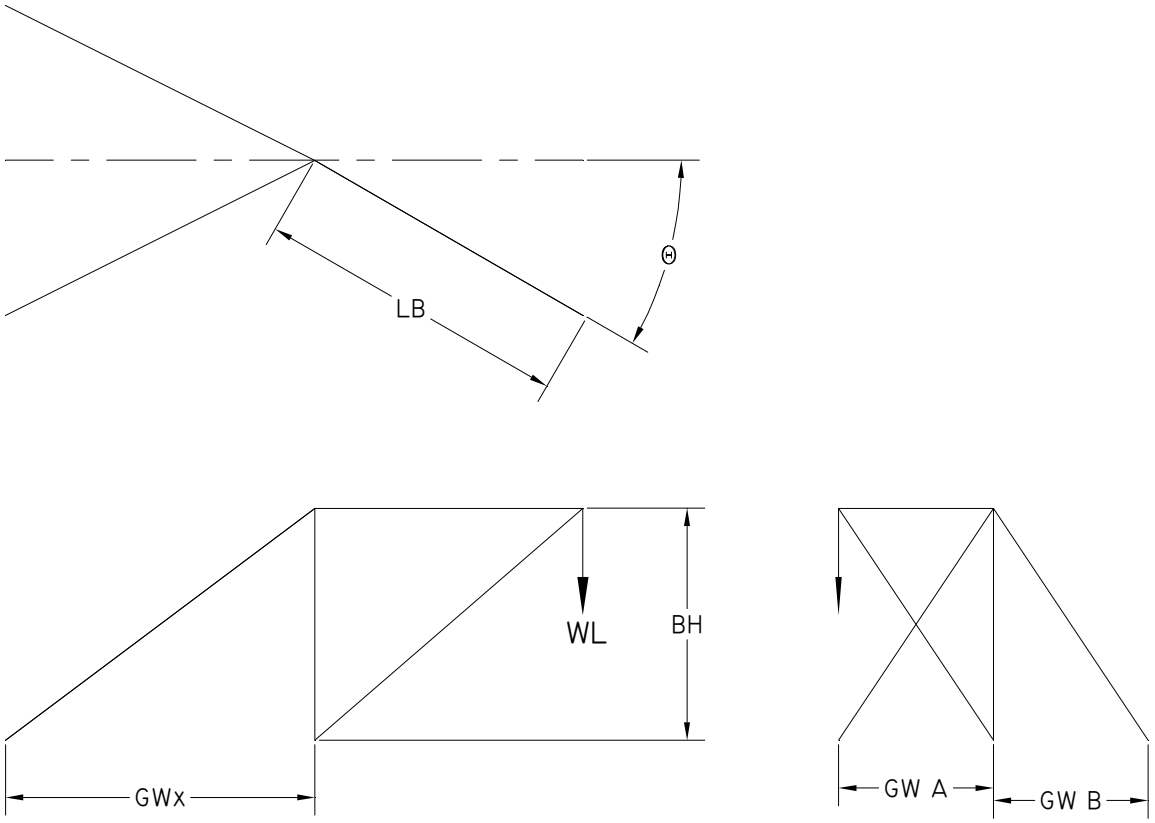
- **Problem 5.10 Boom Analysis**

With the data generated here, the appropriate guy wire can be selected and the guy wire mountings and moorings can be designed so that the boom can be safely used over the entire operational range.



Boom Dimensions:

Total Height: $B_H \equiv 30 \cdot ft$

Boom Length: $L_B \equiv 40 \cdot ft$

Guy Wire Offset: $Gw_x \equiv 40 \cdot ft$

Gw A Offset: $A_z \equiv 20 \cdot ft$

Gw B Offset: $B_z \equiv -30 \cdot ft$

Controled Variables:

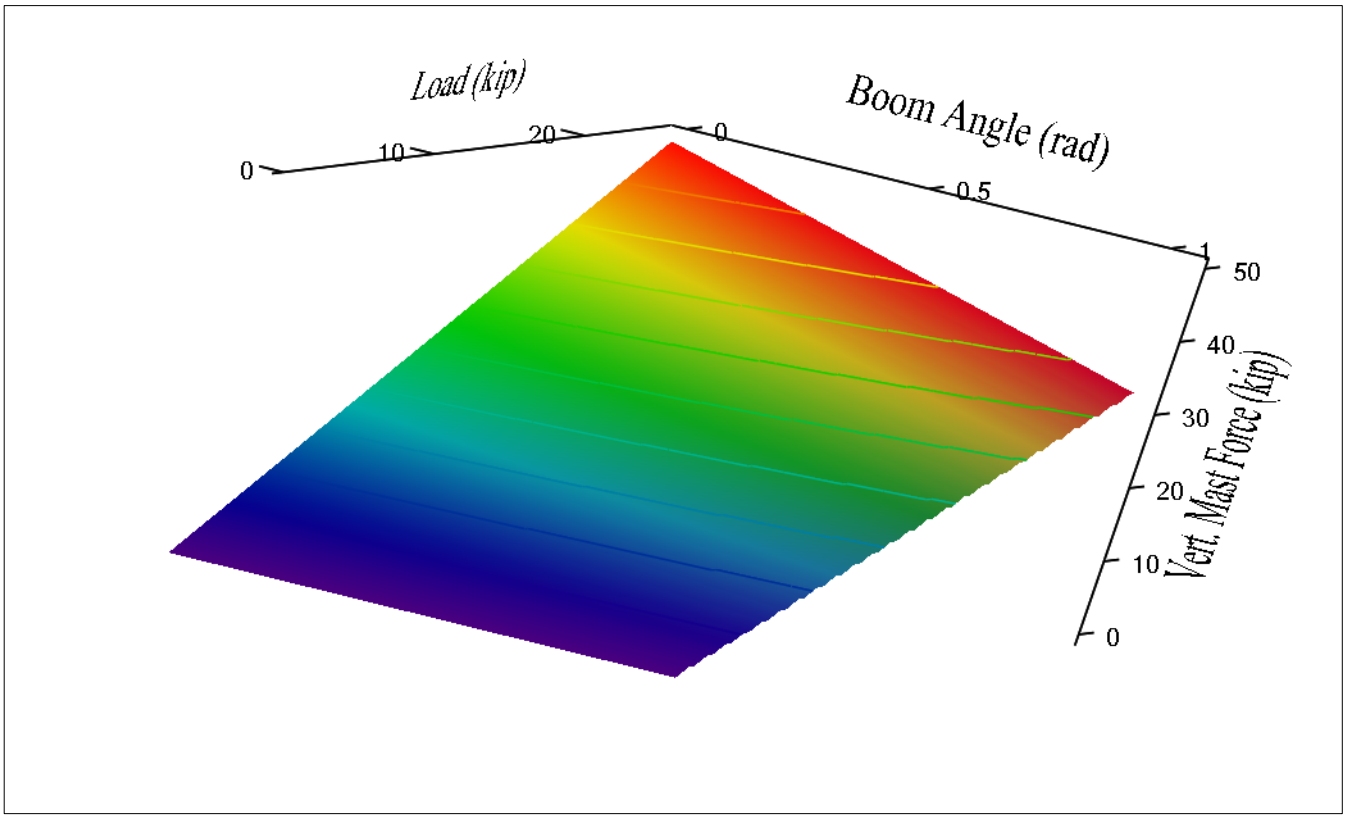
Load: W_L

Angle: θ (deg)

(x-y)

$$\Sigma M_{A\_B} = 0 = W_L\left(\left|Gw_x\right| + \left|L_B\right|\cdot\cos(\theta)\right) - D_y\cdot\left|Gw_x\right|$$

$$D_y\left(W_L,\theta\right) := W_L + W_L\cdot\cos(\theta)$$



D_y

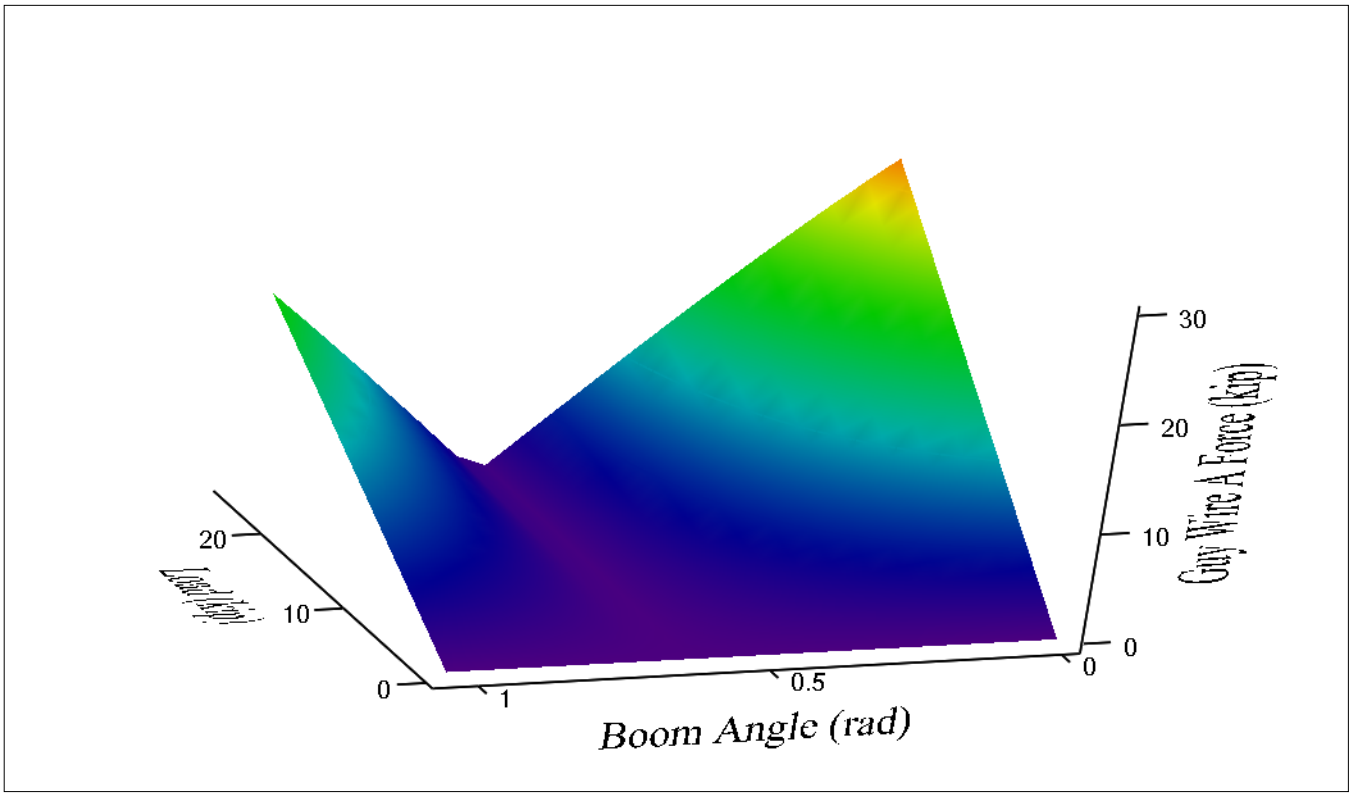
(y-z)

$$\Sigma M_B = 0 = D_y\cdot\left|B_z\right| - W_L\left(\left|B_z\right| + \left|L_B\right|\cdot\sin(\theta)\right) - A_y\cdot\left(\left|A_z\right| + \left|B_z\right|\right)$$

$$A_y\left(W_L,\theta\right) := \frac{W_L}{\left|A_z\right| + \left|B_z\right|}\cdot\left(\left|B_z\right|\cdot\cos(\theta) - \left|L_B\right|\cdot\sin(\theta)\right)$$

$$A_x\left(W_L,\theta\right) := \frac{Gw_x}{B_H}\cdot A_y\left(W_L,\theta\right) \qquad A_{z1}\left(W_L,\theta\right) := \frac{A_z}{B_H}\cdot A_y\left(W_L,\theta\right)$$

$$F_A\left(W_L,\theta\right) := \sqrt{A_x\left(W_L,\theta\right)^2 + A_y\left(W_L,\theta\right)^2 + A_{z1}\left(W_L,\theta\right)^2}$$



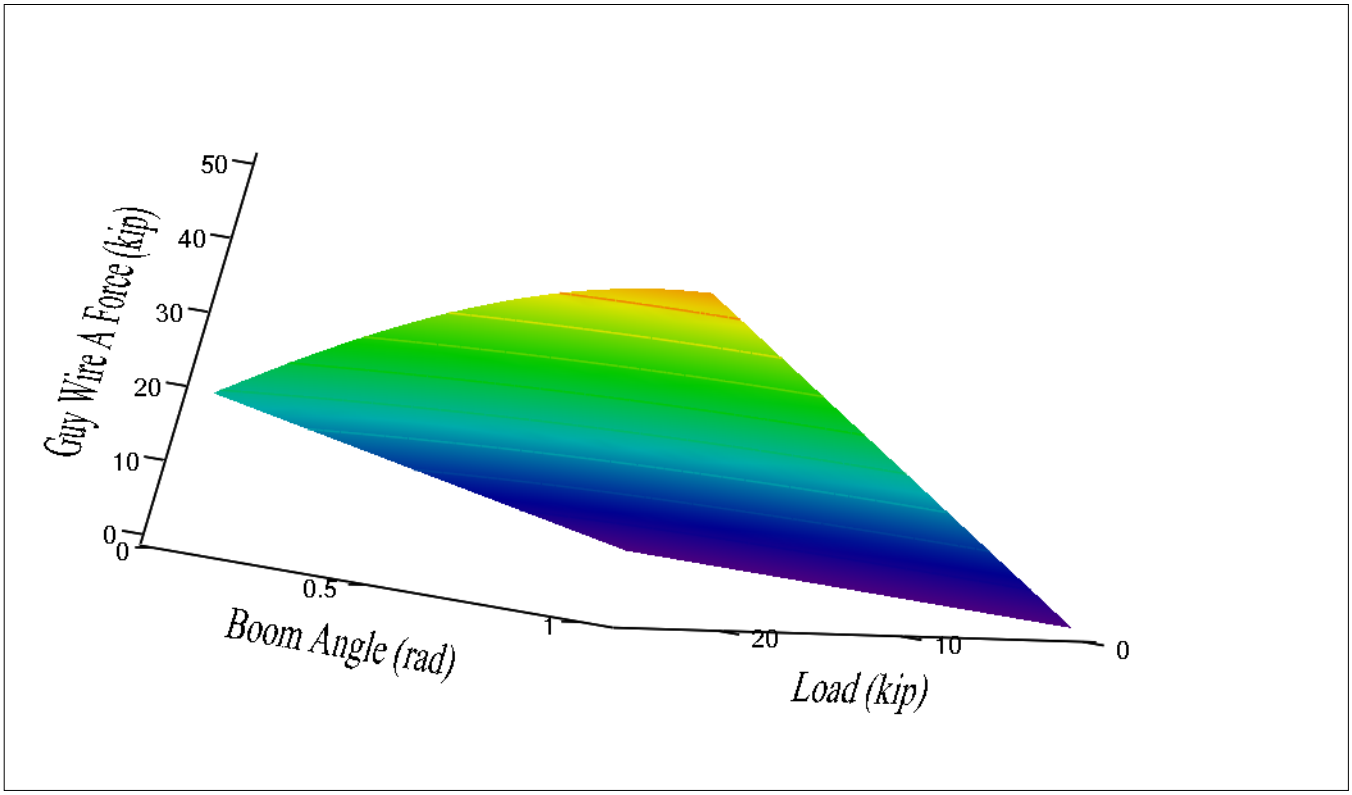
F_A

$$\Sigma M_A = 0 = B_y \cdot \left(\left| A_z \right| + \left| B_z \right| \right) + W_L \left(\left| A_z \right| - \left| L_B \right| \cdot \sin(\theta) \right) - D_y \cdot \left| A_z \right|$$

$$B_y\left(W_L, \theta\right) := \frac{W_L}{\left| A_z \right| + \left| B_z \right|} \cdot \left(\left| A_z \right| \cdot \cos(\theta) + \left| L_B \right| \cdot \sin(\theta) \right)$$

$$B_x\left(W_L, \theta\right) := \frac{Gw_x}{B_H} \cdot B_y\left(W_L, \theta\right) \qquad B_{z1}\left(W_L, \theta\right) := \frac{\left| B_z \right|}{B_H} \cdot B_y\left(W_L, \theta\right)$$

$$F_B\left(W_L, \theta\right) := \sqrt{B_x\left(W_L, \theta\right)^2 + B_y\left(W_L, \theta\right)^2 + B_{z1}\left(W_L, \theta\right)^2}$$



F_B

$P := 2.5kip, 5kip .. 25kip$

$Q := 0deg, \frac{60}{9}deg .. 60deg$

$F_A(P,Q) =$

2.7	kip
2.3	
1.8	
1.3	
0.8	
0.3	
0.2	
0.8	
1.3	
1.8	
5.4	
4.5	
3.6	
2.6	
1.6	
0.6	

$F_B(P,Q) =$

1.9	kip
2.4	
2.8	
3.2	
3.5	
3.8	
4	
4.2	
4.3	
4.3	
3.9	
4.8	
5.6	
6.3	
7	
7.5	