

Summary

This week we had a boom suspended from a spring with tension in it. The boom's mass was complemented by a weight hanging from the top of the boom. The observation is the force of tension against the force of gravity. For calculations, we took the sum of the weight of the boom with the weight hanging from the boom. We predicted an S by taking a weighted sum and dividing it by OC. Force was the Euclidean distance between V and H. We needed to calculate the angle the boom was hanging at by taking the arctangent. Finally we calculated the percent difference.

Data Sheet

Calculated Results					
V	H	F	θ	S _{pred}	% Dif. in S
N	N	N	deg	N	%
9.89	14.85	17.84	33.6	14.85	7.5
10.87	16.887	20.083	0.5719	16.887	6.381
11.85	20.386	23.580	0.5265	20.386	1.912

Calculations

```
>>> def S_pred(OE, Wb, OD, L, OC):  
...     return (OE * Wb + OD * L) / OC  
...  
>>> from math import atan, sqrt  
>>> def F(V, H):  
...     return sqrt(V**2 + H**2)  
...  
>>> def percent_diff(s_meas, s_pred):  
...     return 200 * abs(s_meas - s_pred) / (s_meas + s_pred)  
...
```

```

>>> 2.05 + 8.82
10.870000000000001
>>> 2.05 + 9.8
11.850000000000001
>>> H(0.017, 2.05, 0.042, 8.82, 0.024)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'H' is not defined
>>> S_pred(0.017, 2.05, 0.042, 8.82, 0.024)
16.887083333333333
>>> S_pred(0.018, 2.05, 0.042, 9.8, 0.022)
20.38636363636364
>>> F(10.87, 16.887)
20.083019419400063
>>> F(11.85, 20.386)
23.579896013341536
>>> atan(10.87 / 16.887)
0.5719268624991602
>>> atan(11.85 / 20.386)
0.5265420088935429
>>> percent_diff(18, 16.887)
6.3806002235789805
>>> percent_diff(20, 20.386)
1.911553508641605

```

Analysis

I think we had satisfyingly low percent difference between S_{pred} and S_{meas} . It's interesting that the calculated angle θ between forces is complemented by the empirical angle that the boom is hanging at.

Questions

1. It would be possible. I would have 2 equations and 2 unknowns.
2. It is not always the case that two forces acting on an object can be combined into one force. If the object is large and the forces are acting on different points, it would be difficult to combine them. Also, if the forces are applied at different times, there would be an issue combining the forces.
3. Yes, the sum of moments would hang lower if we calculated it about point D.