Lab Write-up

Bijan Varjavand

September 30, 2016

1 Introduction

blah1

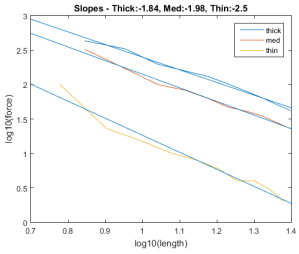
2 Error Analysis

Our buckling load equation is

$$P = \frac{E\pi^3 D^3}{4L^2}$$

$$E = \frac{4PL^2}{\pi^3 D^4}$$

We can confirm the powers by plotting the data on log scales.



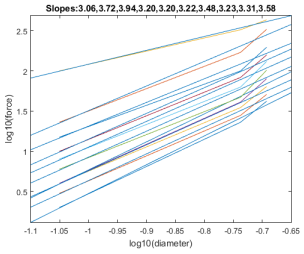


Figure 1: Averages for the slopes = -2.1 and 3.6

Solving for E using our equation, we get 30 values from all our data points. Averaging the E values, we get 2.32 GPa.

The ruler we used had an error of ± 0.5mm, and the scale had an error of ± 1g. Converting error from the scale into Newtons, it becomes ± 0.0098N.

Error propagation given by

$$\frac{\delta E}{E} = \frac{4}{\pi^3}\sqrt{(\frac{4\delta L}{L})^2 + (\frac{2\delta D}{D})^2 + (\frac{\delta P}{P})^2}$$

$$\frac{\delta E}{E} = \frac{4}{\pi^3}\sqrt{(\frac{4(0.05cm)}{L})^2 + (\frac{2(0.05cm)}{D})^2 + (\frac{(0.001kg)}{P})^2}$$

I found $\frac{\delta e}{E}$ values for all 30 data points, then averaged all of them to get $\frac{\delta E}{E} = 0.0967$. Multiplying by the value for E we found, we get $\delta E = 224$ MPa. This results in

$$2.32 \pm 0.22 Gpa$$

3 Appendix

Thick			
Length(cm)	Mass(g)	Force(N)	Diameter(cm)
25	42	412.02	0.203
23	51	500.31	
21	64	627.84	
19	80	784.80	
17	102	1000.62	
15	131	1285.11	
13	158	1549.98	
11	197	1932.57	
9	329	3227.49	
7	432	4237.92	

Medium			
Length(cm)	Mass(g)	Force(N)	Diameter(cm)
25	23	225.63	0.183
23	28	274.68	
21	35	343.35	
19	41	402.21	
17	47	461.07	
15	63	618.03	
13	83	814.23	
11	100	981.00	
9	170	1667.70	
7	325	3188.25	

Thin			
Length(cm)	Mass(g)	Force(N)	Diameter(cm)
24	2	19.62	0.089
22	3	29.43	
20	4	39.24	
18	4	39.24	
16	6	58.86	
14	8	78.48	
12	10	98.10	
10	15	147.15	
8	23	225.63	
6	100	981.00	