Make the Eigenvalue Problem Resonate with Our Students

Measuring the Spring Constant

The spring constant can be measured with a low-cost method. Rather than purchasing calibrated masses we use US treasury coins, which have uniform masses and, even in the smallest budget schools, are readily available.

A digital kitchen scale can be used to measure the mass of a coin, e.g. a US quarter as follows: Place several quarters on the scale (perhaps 30) and measure the average value. Then hang a selected spring from a frame and attach a small plastic bag that also has been weighed from the lower end of the spring. Measure the spring extension. Successively add coins to the bag and measure the spring extension as each successive quarter is added to the bag. Record the data in a spread sheet with a column for weight added and one for spring extension. Use a least-squares fit utility (such as LINEST or a trend line) available within the spread sheet to compute the slope of the plot of extension vs added weight (The force in newtons is m* g). The slope will yield the spring constant in N/m. Hooke's Law formula is F (Newtons) = k x where x is measured in meters. The spring constant k will have the units of Newtons/meter.

The next page, copied from a spread sheet provides typical values from our work.

Spring Constant Measurements

nominally 3.4 N/m

Mass units: 0.0057 kg/quarter

0.002 bag and spring

Measured using 30 quarters, and taking average

Method: Suspend plastic bag and add mass with quarters (US coins).

Number quarters	Mass (kg)	Spring length	Delta	Force (N)
0	0.002	0.037		0.0196
1	0.008	0.053	0.0160	0.07546
2	0.013	0.07	0.0170	0.13132
3	0.019	0.086	0.0160	0.18718
4	0.025	0.101	0.0150	0.24304
5	0.031	0.117	0.0160	0.2989
6	0.036	0.134	0.0170	0.35476
7	0.042	0.15	0.0160	0.41062
8	0.048	0.166	0.0160	0.46648
9	0.053			
10	0.059			

Result: spring constant measured is 3.47 N/m