1 • Hypotheses

The spring constant will remain the same when the springs are in parallel.

The spring constant will be halved when the springs are in series.

2 • Procedure

2.1 Parallel

1. Hang two yellow springs from the spring brakcet.
2. Hang a mass from the two springs.
3. Stretch mass on springs.
4. Record time for 10 oscillations of mass.
5. Divide by 10 to find period.
6. Repeat with nonidentical springs.

2.2 Series

1. Hang blue spring on spring bracket, then hang another blue spring on the spring.
2. Hang a mass from the bottom of second spring.
3. Stretch mass on springs.
4. Record time for 10 oscillations of mass.
5. Divide by 10 to find period.
6. Repeat with green spring on bottom.

3 • Data

3.1 Spring Constants

Yellow Spring k	Blue Spring k	Green Spring k
35	30	50

3.2 Parallel Same Springs

Mass (kg)	Period (s)	Effective k
1	0.785	64
1	0.789	63.353
0.5	0.57	60.693
0.5	0.574	59.85
0.5	0.576	59.435
0.5	0.568	61.121
0.5	0.569	60.907
0.5	0.644	47.546
0.7	0.651	65.141
0.7	0.679	59.879

3.3 Parallel Different Springs

Mass (kg)	Period (s)	Effective k
1	0.73	74.007
1	0.731	73.805
0.5	0.541	67.374
0.5	0.549	65.425
0.5	0.547	65.904
0.5	0.542	67.126
0.7	0.624	70.9
0.7	0.633	68.899
0.7	0.623	71.128
0.7	0.629	69.778

3.4 Series Same Springs

Mass (kg)	Period (s)	Effective k
0.5	1.12	15.72
0.5	1.12	15.72
0.5	1.12	15.72
0.2	0.76	13.656
0.2	0.772	13.235
0.2	0.77	13.304
0.4	1.026	14.986
0.4	1.02	15.163
0.4	1.012	15.403

3.5 Series Same Springs

Mass (kg)	Period (s)	Effective k
1	1.498	17.575
1	1.493	17.693
0.2	0.744	14.25
0.2	0.744	14.25
0.2	0.748	14.098

4 • Derivations

4.1 Experimental k

$$T = \tau\sqrt{\frac{m}{k}}$$
$$T^2 = \frac{m}{k}$$
$$k = \frac{m}{T^2}$$

4.2 Parallel k

$$k_1x + k_2x = F_g$$
$$k_1 + k_2 = \frac{F_g}{x}$$
$$k_{eff}x = F_g$$
$$k_{eff} = \frac{F_g}{x}$$
$$k_{eff} = k_1 + k_2$$

4.3 Series k

$$k_1x_1 = k_2x_2 = F_g$$
$$x_1 = \frac{F_g}{k_1}$$
$$x_2 = \frac{F_g}{k_2}$$
$$k_{eff}(x_1 + x_2) = F_g$$
$$k_{eff}(\frac{F_g}{k_1} + \frac{F_g}{k_2}) = F_g$$
$$k_{eff}(\frac{1}{k_1} + \frac{1}{k_2}) = 1$$
$$k_{eff} = \frac{1}{\frac{1}{k_1} + \frac{1}{k_2}}$$

5 • Conclusion

My hypothesis about parallel springs was incorrect, as the effective spring constant for parallel springs is simply the sum of all the spring costants in the system.

My hypothesis about springs in series was true for identical springs in series, but it does not remain true for nonidentical springs.