Coupled springs

Philippe W. Courteille, 05/02/2021

Solution: *For a spring assembly in series we have the two equations,*

$$mg - D_1 x_1 = 0 \quad and \quad mg - D_2(x_2 - x_1) = 0 \ .$$

Hence,

$$x_2 = \frac{D_1 + D_2}{D_2} x_1 = \frac{D_1 + D_2}{D_1 D_2} mg \ ,$$

or

$$D_{tot} = \left(\frac{1}{D_1} + \frac{1}{D_2} \right)^{-1} \ .$$

And analogously for a parallel assembly we have the equation

$$mg - D_1 x - D_2 x = 0 \ .$$

Hence,

$$D_{tot} = D_1 + D_2 \ .$$

By applying these rules to the shown assemblies, we get
a. $D = D_1 + D_2$
b. $D = \left(\frac{1}{D_1 + D_2} + \frac{1}{D_3} \right)^{-1} + D_4$
c. $D = \left(\frac{1}{D_1 + D_2 + D_3} + \frac{1}{D_4} \right)^{-1} + \left(\frac{1}{D_5} + \frac{1}{D_6 + D_7 + D_8 + D_9} \right)^{-1}$