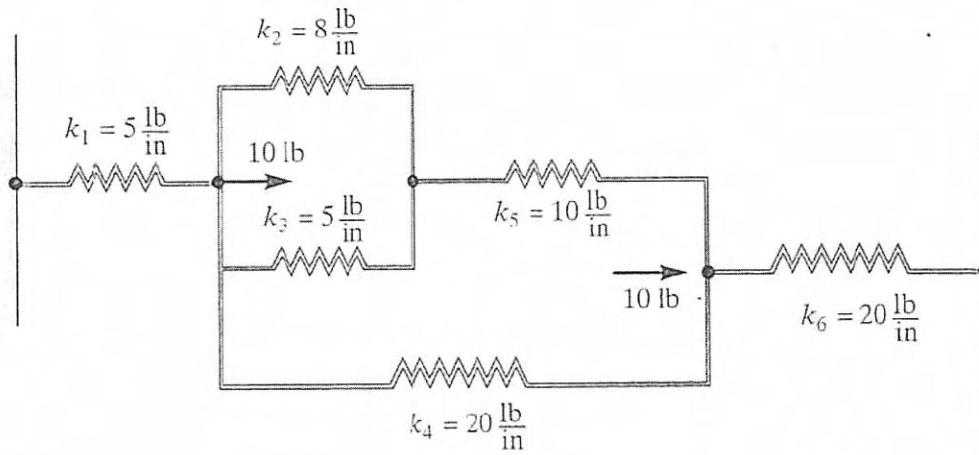
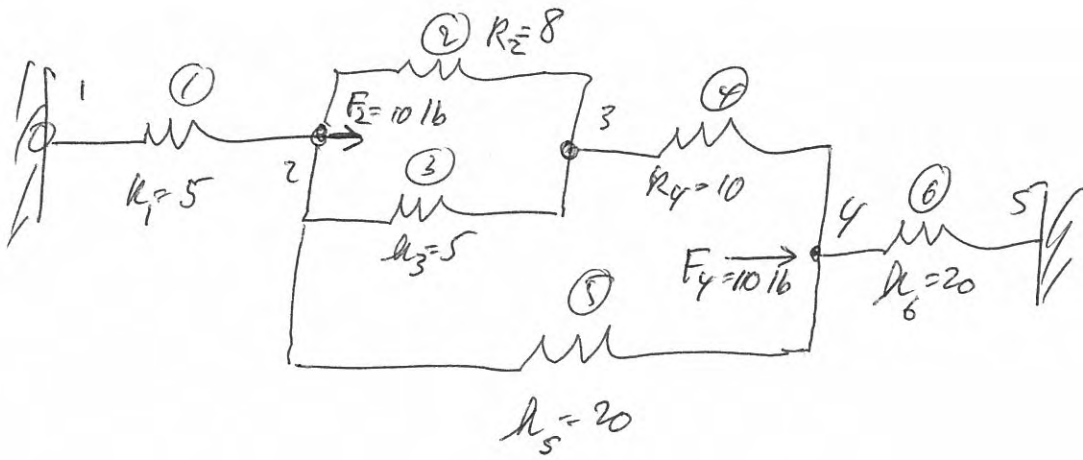


ME 345: Example spring problem (more complicated arrangement of springs)

Given the problem below, calculate the nodal displacements.





Solution

Note: 5 nodes, 6 elements.

$$\begin{bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \\ F_5 \end{bmatrix} = \begin{bmatrix} 5 & -5 & 0 & 0 & 0 \\ -5 & 5+8 & -8-5 & -20 & 0 \\ 0 & -8-5 & 8+5+10 & -10 & 0 \\ 0 & -20 & -10 & 10+20+20 & -20 \\ 0 & 0 & 0 & -20 & 20 \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \end{bmatrix}$$

GLOBAL STIFFNESS MATRIX

APPLY BC's ($d_1 = d_5 = 0$) and solve:

$$\begin{bmatrix} F_2 \\ F_3 \\ F_4 \end{bmatrix} = \begin{bmatrix} 38 & -13 & -20 \\ -13 & 23 & -10 \\ -20 & -10 & 50 \end{bmatrix} \begin{bmatrix} d_2 \\ d_3 \\ d_4 \end{bmatrix}$$

$d_2 = .962$
 $d_3 = .874$
 $d_4 = .760$
 all units inches!