ME 304 – Finite Element Analysis, Fall 2019
Assignment: Linear Springs, Global Matrices

Estimated time to completion: 2-3 hours.

Develop the Global Matrices for F = Ku. After creating the matrices, apply boundary conditions and solve for the unknown forces and/or displacements. You may use the same Global matrices for problem 2 as problem 1 (you do not need to recreate them since they are the same) and for problems 3 and 4.
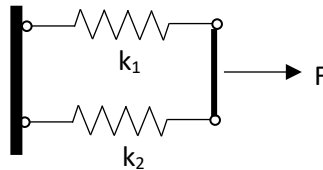
1. Given two springs in series as shown below with F=100kN, k_1=10kN/mm, k_2=20kN/mm.
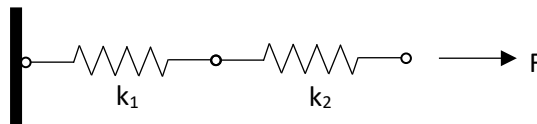
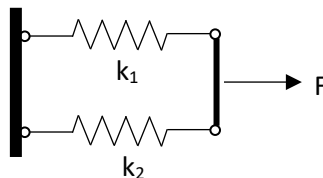2. Given two springs in series as shown below with δ_{tot} = 5mm, k_1=30kN/mm, k_2=20kN/mm.
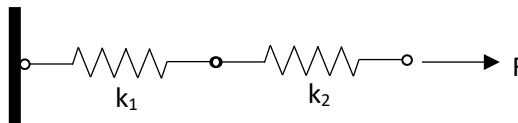
3. Given two springs in parallel as shown below. They are attached in such a way as the length of spring 1 always equals the length of spring 2 ($\delta_1 = \delta_2 = \delta_{tot}$). F=100kN, k_1=10kN/mm, k_2=20kN/mm
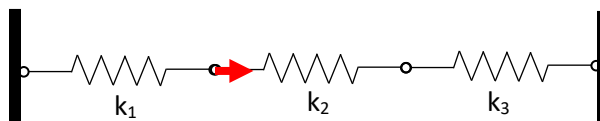

4. Given two springs in parallel as shown below. They are attached in such a way as the length of spring 1 always equals the length of spring 2. $\delta_1 = \delta_2 = \delta_{tot}$ = 5mm, k_1=30kN/mm, k_2=20kN/mm.

5. Given three springs in series as shown below with a force applied at the second node of 450N. Determine reaction forces at the walls and displacement of all nodes. k_1=10kN/m, k_2=20kN/m, k_3=10kN/m

6. This problem is very similar to problem 5, but with different spring constants and forces. There is a force of 1000pounds applied at node 2 (40" from the left end). The three springs are actually flat plates of steel (cross section of ¼" by 2"). First, determine the spring constants of the three plates, then using the generic Global Matrix equation developed in problem 5, determine the reaction forces at the walls and displacement at all nodes. The dimensions shown below are the node locations.
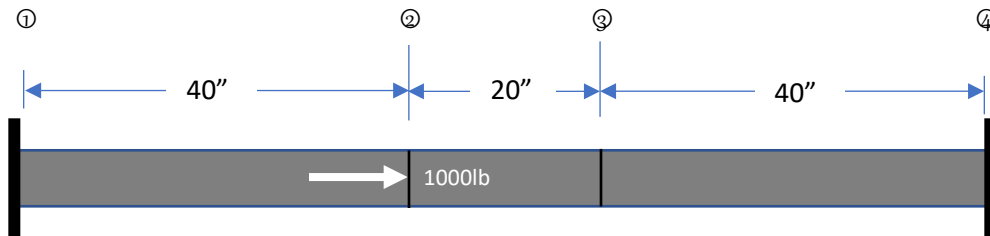
7. Model problem 6 using ANSYS Workbench (search in Kiosk for "Workbench"). See Section 7.2 in the *Finite Element Simulation* book to help you through it. Determine the reaction forces at the walls and displacement at all nodes.

    - Before creating the model, create tables to define node points, elements, and boundary conditions (as is done in Section 7.2)
    - Include printout of your results.

Reminder: This is just a reminder to remember to advise your new students on saving their files to their P drives or OneDrive through https://myapps.up.edu when using the virtual machine kiosks before logging off. This will ensure they do not lose any of their saved work upon the reset of the virtual machines.