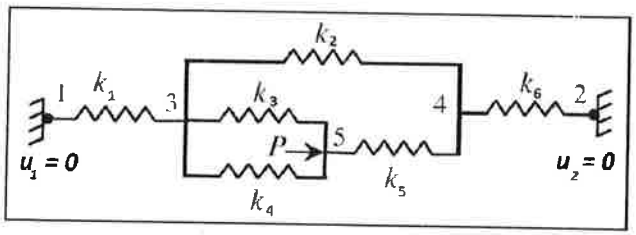
MECH 517 – Finite Element Analysis

Homework 2

The suggested reading for the first week gives the hand solution for the equilibrium of a system of three springs. The Downloads link gives the Matlab script for the same system. Both references assigned zero displacements to the two end nodes (1 and 2).

Use either Eq 16 of the readings, or the Matlab script to impose new end displacements and obtain the other three system displacements and the two system reactions.

The system is displayed below:



Part 1:

Set $u_1 = 0$ m and $u_2 = 0.2$ m

Using modified MATLAB script (updating given displacements), results are listed below:

Displacements:
$u_3 = 0.1667$ m
$u_4 = 0.2000$ m
$u_5 = 0.2333$ m

Reactions:
$R_1 = -20$ kN
$R_2 = 0$

Part 2:

Set $u_1 = 0.2$ m and $u_2 = 0$ m

Using modified MATLAB script (updating given displacements), results are listed below:

Displacements:
$u_3 = 0.2128$ m
$u_4 = 0.1538$ m
$u_5 = 0.2487$ m

Reactions:
$R_1 = -1.5385$ kN
$R_2 = -18.4615$ kN

Part 3:

In addition to the above two parts use the Matlab script to impose displacements $u_1 = 0.2$ m and $u_2 = -0.2$ m. Obtain the other three system displacements and the two system reactions. Obtain the displacement gradient in spring element 2. Obtain the element end reactions for spring 5.

Set $u_1 = 0.2$ m and $u_2 = -0.2$ m

Using modified MATLAB script (updating given displacements), results are listed below:

Displacements:
$u_3 = 0.1359$ m
$u_4 = 0.0308$ m
$u_5 = 0.1564$ m

Reactions:
$R_1 = 7.6923$ kN
$R_2 = -27.6923$

Displacement gradient for spring element 2:
$\varepsilon_2 = -3.504 \times 10^{-2}$ m/m

Element end reactions for spring element 5:
$R_{5L} = 15.0769$ kN
$R_{5R} = -15.0769$ kN