

Lab-10

Develop the function for the Truss Member Forces

The displacement and forces at unknown DOFs are required to find out the member forces in the truss. The member forces can be determined using following equation.

$$\mathbf{q} = \mathbf{k}'\mathbf{TD}$$

Expanding this equation yields

$$\begin{bmatrix} q_N \\ q_F \end{bmatrix} = \frac{AE}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} \lambda_x & \lambda_y & 0 & 0 \\ 0 & 0 & \lambda_x & \lambda_y \end{bmatrix} \begin{bmatrix} D_{Nx} \\ D_{Ny} \\ D_{Fx} \\ D_{Fy} \end{bmatrix}$$

Since for equilibrium, only one of the forces has to be found. Here we will determine the one that exerts tension in the member,

$$q_F = \frac{AE}{L} \begin{bmatrix} -\lambda_x & -\lambda_y & \lambda_x & \lambda_y \end{bmatrix} \begin{bmatrix} D_{Nx} \\ D_{Ny} \\ D_{Fx} \\ D_{Fy} \end{bmatrix}$$

In particular, if the computed result using this equation is negative, the member is then in compression.