Lab-9

Develop the program for the nodal displacement and reactions.

Once the structure stiffness matrix is formed, the global force components Q acting on the truss can then be related to its global displacements D using

$$Q = KD$$

This equation is referred to as the structure stiffness equation. Since we have always assigned the lowest code numbers to identify the unconstrained degrees of freedom, this will allow us now to partition this equation in the following form*:

$$\begin{bmatrix} Q_k \\ \cdots \\ Q_u \end{bmatrix} = \begin{bmatrix} K_{11} & \vdots & K_{12} \\ \cdots & \cdots & \cdots \\ K_{21} & \vdots & K_{22} \end{bmatrix} \begin{bmatrix} D_u \\ \cdots \\ D_k \end{bmatrix}$$

Q_k, D_k = Known external loads and displacements; the loads here exist on the truss as part of the problem, and the displacements are generally specified as zero due to support constraints such as pins or rollers.

Q_U, D_U = Unknown loads and displacements; the loads here represent the unknown support reactions, and the displacements are at joints where motion is unconstrained in a particular direction.

K= Structure stiffness matrix, which is partitioned to be compatible with the partitioning of Q and D.

$$Q_k = K_{11}\, D_u + K_{12} D_k$$

$$Q_u = K_{21} D_u + K_{22} D_k$$