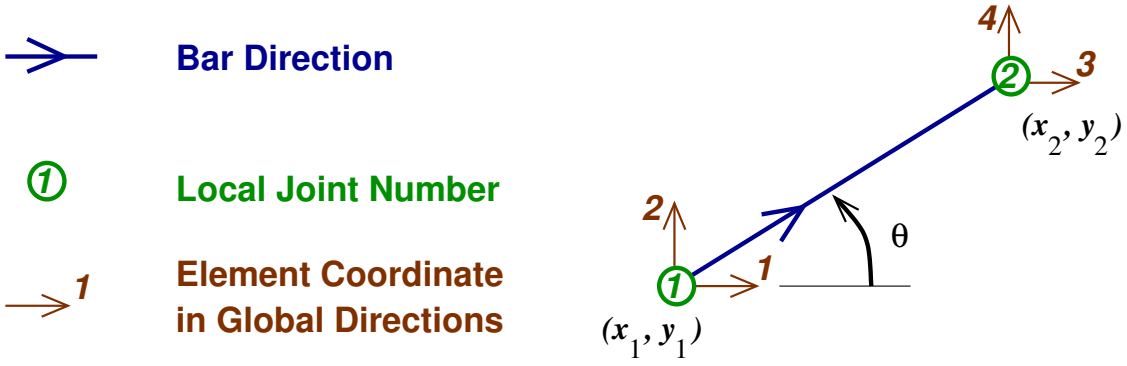
Duke University — CE 131L. Matrix Structural Analysis

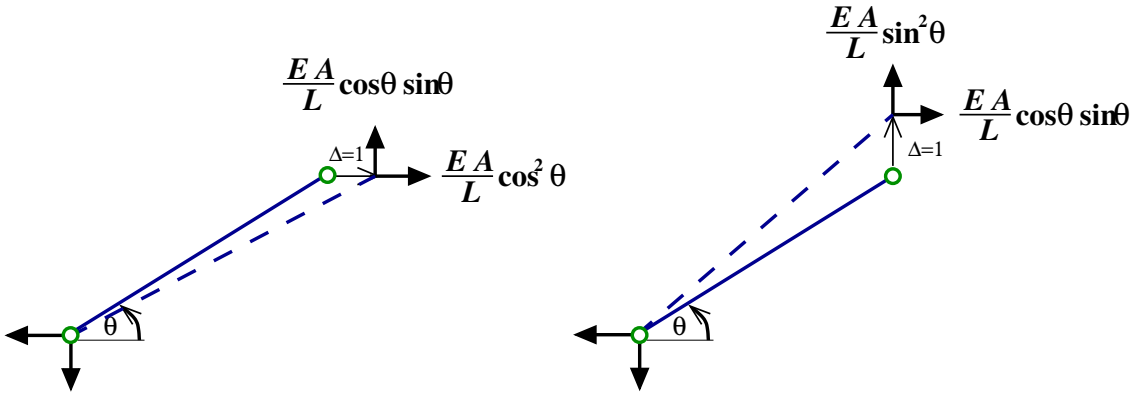
Stiffness Matrix Reference Sheet for 2D Truss Bars



$$L = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad c = (x_2 - x_1)/L \qquad s = (y_2 - y_1)/L$$

$$\mathbf{k} = \frac{EA}{L}\begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \qquad \mathbf{K} = \frac{EA}{L}\begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

$$T = \frac{EA}{L}[c(v_3 - v_1) + s(v_4 - v_2)]$$



Coordinate System	Local	Global
Element Deflection	**u**	**v**
Element Force	**q**	**f**
Element Stiffness	**k**	**K**
Structural Deflection	-	**d**
Structural Loads	-	**p**
Structural Stiffness	-	$\mathbf{K_s}$

$$\mathbf{q} = \mathbf{k}\,\mathbf{u} \qquad \mathbf{f} = \mathbf{K}\,\mathbf{v} \qquad \mathbf{p} = \mathbf{K_s}\,\mathbf{d}$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$