

# Stiffness Matrix [K]

Let's Consider.

$w_1, w_2, w_3 \dots w_n \rightarrow$  Nodal displacement parameters  
or termed as dof

$W_1, W_2, W_3 \dots W_n \rightarrow$  Corresponding nodal loads,  
acting at dof.

$$\{W\} = \begin{Bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{Bmatrix}, \quad \{w\} = \begin{Bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{Bmatrix}$$

We know that

$$\{W\} = [K] \{w\} \rightarrow \textcircled{1}$$

$W \Rightarrow$  Nodal loads

$K \Rightarrow$  Stiffness matrix

$w \Rightarrow$  DOF

We know that,

Work done,  $P =$  Strain energy

$$\Rightarrow P = \frac{1}{2} W_1 w_1 + \frac{1}{2} W_2 w_2 + \frac{1}{2} W_3 w_3 \dots + \frac{1}{2} W_n w_n$$

$$P = \frac{1}{2} [W_1, W_2, W_3 \dots W_n] \begin{Bmatrix} w_1 \\ w_2 \\ w_3 \\ \vdots \\ w_n \end{Bmatrix}$$

$$= \frac{1}{2} \{ \underline{[W]} \}^T \{w\} \rightarrow \textcircled{2}$$

$[ ] \rightarrow$  Row matrix

$\{ \} \rightarrow$  Column matrix

