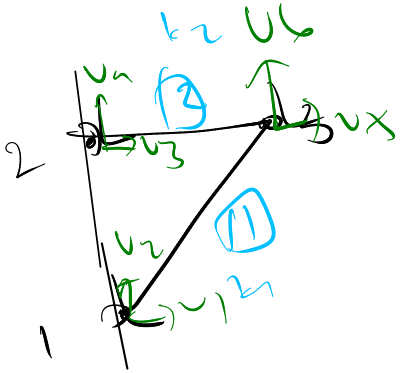
Finite Element

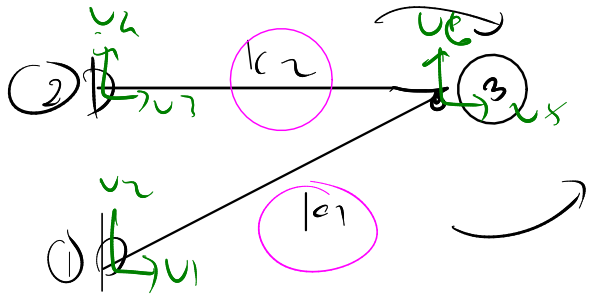
$F = k\,d \Rightarrow$

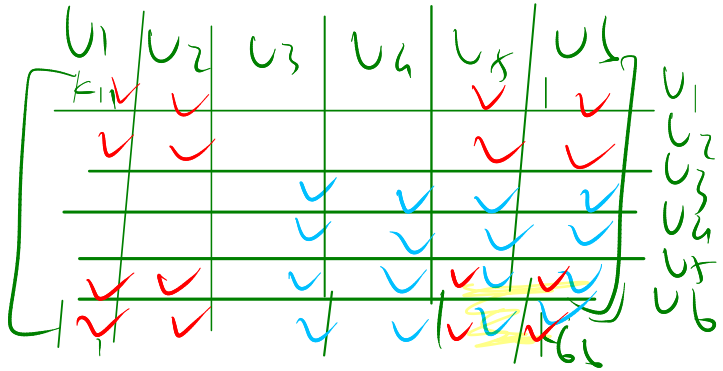
$[k]\{u\} = \{F\}$



$[k]\{u\} = \{F\}$

- $[k]$: matriks kekakuan global → $[6 \times 6]$ → 2 × 2
- $\{u\}$: nodal displacement → $\begin{Bmatrix} u_1 \\ \vdots \\ u_6 \end{Bmatrix}$ → (2, 1)
- $\{F\}$: vektor gaya → $\begin{Bmatrix} f_1 \\ \vdots \\ f_6 \end{Bmatrix}$ → (2, 1)

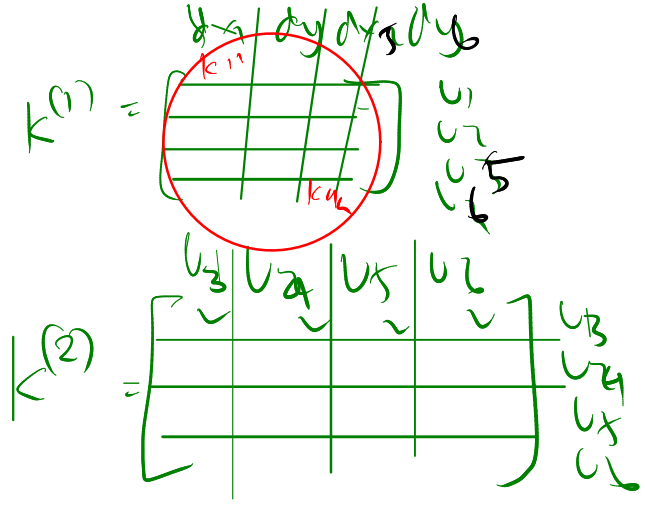




$$[K] =$$

$$v = k_1$$

$$v = k^{(2)}$$



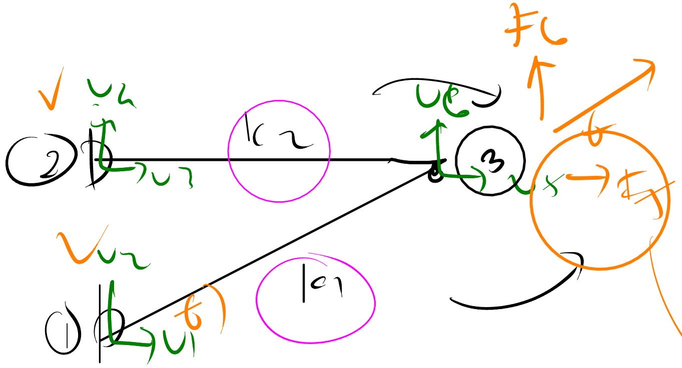
$$[K] = \begin{bmatrix} k_1/2 & k_1/2 & 0 & 0 & -k_1/2 & -k_1/2 \\ k_1/2 & k_1/2 & 0 & 0 & -k_1/2 & -k_1/2 \\ 0 & 0 & k_2 & 0 & -k_2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ -k_1/2 & -k_1/2 & -k_2 & 0 & k_1/2 + k_2 & k_1/2 \\ -k_1/2 & -k_1/2 & 0 & 0 & k_1/2 & k_1/2 \end{bmatrix}$$

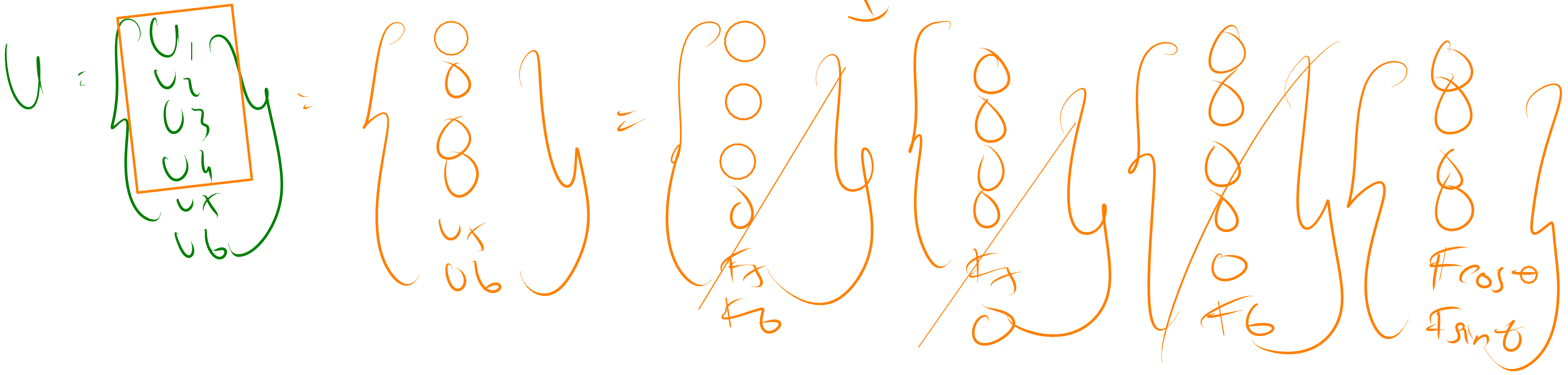
$$[K]\{u\} = \{F\}$$

Finite Element

Edof → k → K, f → bc → Solve → element displacement → Stress / Strain

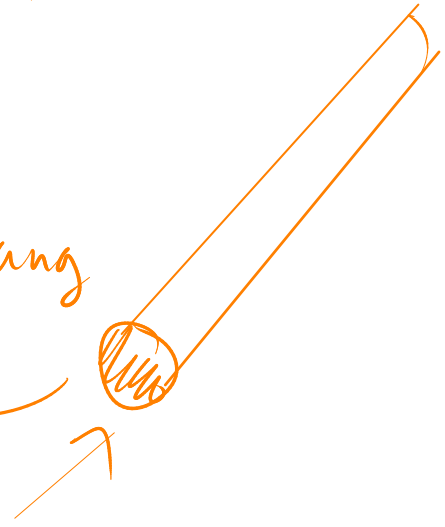
$$[k]\{u\} = \{F\}$$





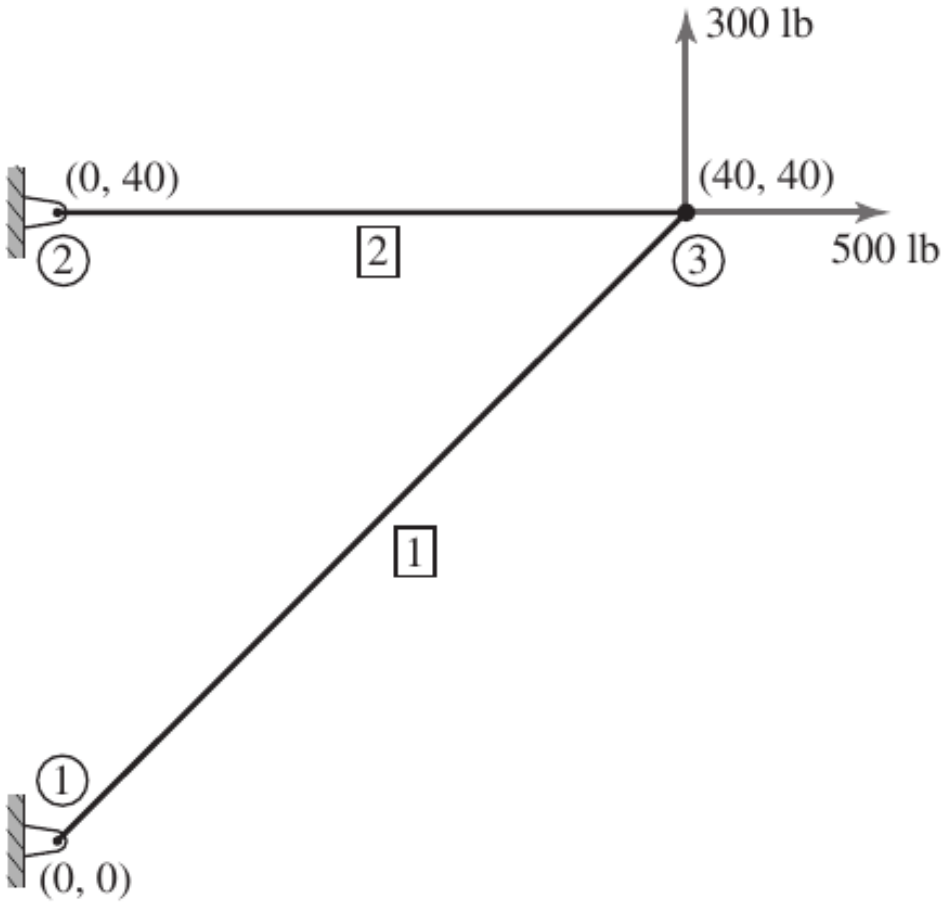
Stress ⇒ $\sigma = E \cdot \varepsilon = \frac{F}{A}$

- ε → Strain
- F → Gaya (Normal)
- E → Modulus Young / Elastisitas
- A → luas penampang



Diketahui :

E1 = E2 =
10 × 10^6 lb/in.2 and cross-sectional areas A1 = A2 = 1.5 in



Jawaban :

determine the displacement components of node 3, the reaction force components at nodes 1 and 2, and the element isplacements, stresses, and forces

a) U_5 & U_6

b) r_1 , r_2 , r_3 , r_4

c) ed_1, ed_2

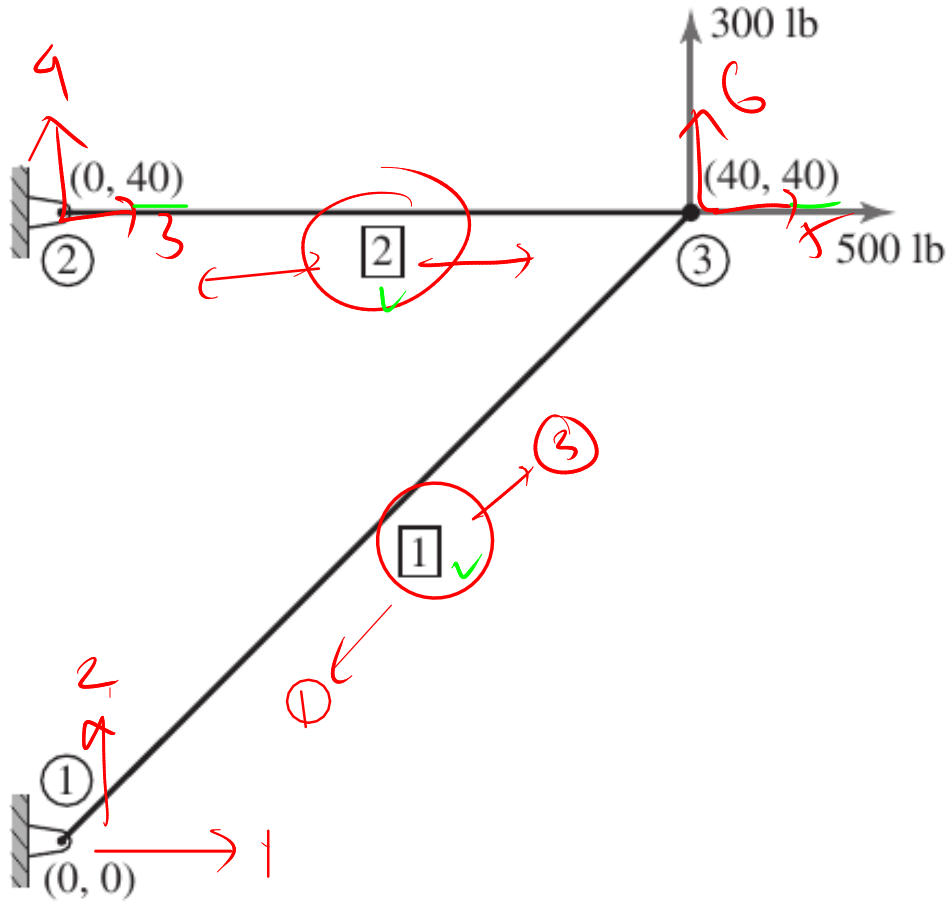
d) σ, $\sigma = \frac{F}{A}$

e) f)

Solusi komputasi FEM

5 Edof

2 Posisi koordinat tiap n



ex1 = [0, 0]

ey1 = [0, 40]

ex2 = [0, 40]

ey2 = [40, 40]

② coordinate

↓

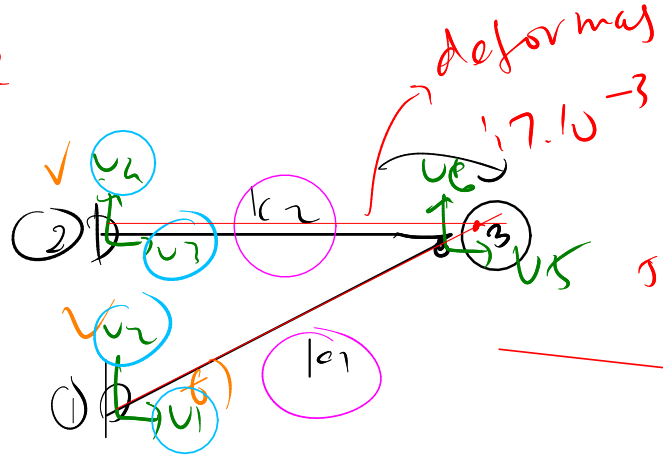
③ K, f

$k^{(1)}$ 4×4

$k^{(2)}$ 4×4

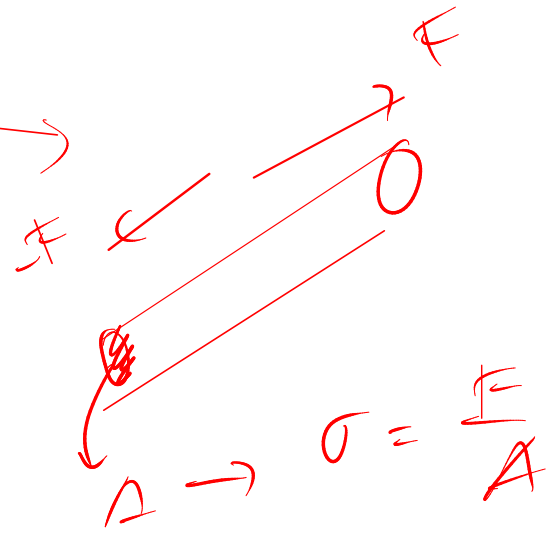
k 6×6

↓ zeros



$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & & & & & 0 \\ 0 & & & & & 0 \\ 0 & & & & & 0 \\ 0 & & & & & 0 \\ 0 & & & & & 0 \end{bmatrix} \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ u_5 \\ u_6 \end{Bmatrix} = \begin{Bmatrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ f_5 \\ f_6 \end{Bmatrix}$$

f



$$\sigma = E\varepsilon \;,\; \varepsilon = \frac{\sigma}{E}$$