No: Date: __/__/____

Input Parameters.

① node ID nodal co-ordinates

② ~~4~~. element ID Starting node, ending node section level volumnce, ~~material~~ section ID

~~3~~ ~~material define~~

③
- section ID.
- Rectangular width, depth
  circula r.
- nct
- steel layers steel area distance from middle.
- concrete material
- steel material.

④ · Boundary conditions.

node	dof
1	1 2 3
4	1 2 3

⑤ Structure level iteration • volumnce • convergence criteria
• max iteration.

⑥ Load controlling dof

⑦ Displacement control Force ~~decide~~ control.

reference load vector.

step size (+) (−)

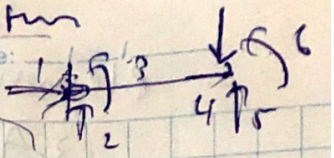
number steps

⑧ external load,
dof
force step size, number of steps

No:

Date:

* calculating initial structm stiffness:

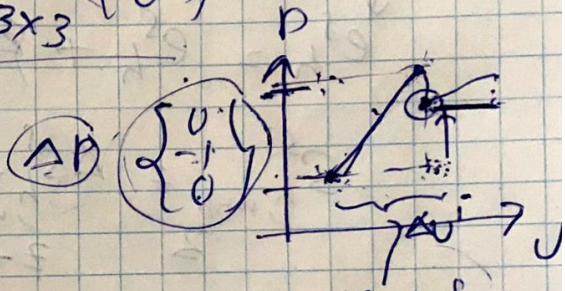


① structm level

$$\begin{Bmatrix} F_1 \\ F_2 \\ F_3 \\ 0 \\ -1 \\ 0 \end{Bmatrix} = \begin{bmatrix} & & \\ & & \\ & & \\ & & \\ & & \\ & & \end{bmatrix} \begin{Bmatrix} 0 \\ 0 \\ 0 \\ u_4 \\ u_5 \\ u_6 \end{Bmatrix}$$

I Structm stiffness → applying boundary

$$\begin{Bmatrix} u_4 \\ u_5 \\ u_6 \end{Bmatrix} = \underbrace{\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}^{-1}}_{K^{i-1}_{3\times3}} \begin{Bmatrix} 0 \\ -1 \\ 0 \end{Bmatrix}$$



ΔP $\begin{Bmatrix} 0 \\ -1 \\ 0 \end{Bmatrix}$

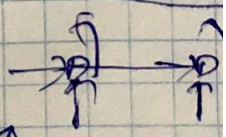
$$\begin{Bmatrix} \text{unbalanced} \\ \text{force} \end{Bmatrix} = \Delta P^{i-1} \begin{Bmatrix} 0 \\ -R \\ 0 \end{Bmatrix}$$

$$\begin{Bmatrix} \text{resisting} \\ \text{force} \end{Bmatrix}_i = K_i \Delta U^i \rightsquigarrow \{\ \}_{6\times1}$$

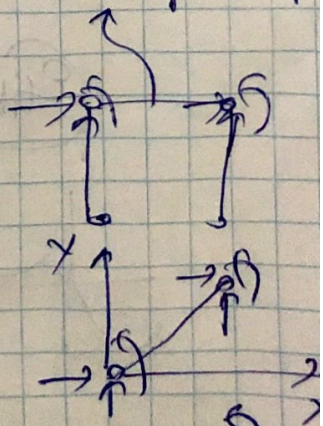
$$\begin{Bmatrix} 0 \\ 0 \\ 0 \\ u_4 \\ u_5 \\ u_6 \end{Bmatrix}$$

$$\boxed{\text{unbalanced force } i = \text{unbalanced force } i-1 - \text{resisting force}}$$

$$\underbrace{K_i^{-1}}_{3\times3} \times \text{unbalanced force} = \Delta U_{i+1}$$

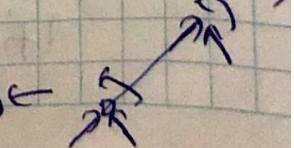


$$\epsilon = \frac{1}{2} \{\Delta u\}^T \{\text{unbalanced force}\}$$



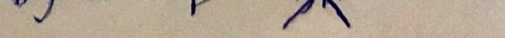
② converting to local co-ordinates

$$\Delta q^e_{\text{local},i} = [\Gamma_{ROT}] \Delta q_{\text{global},i} \begin{Bmatrix} - \\ - \\ - \\ - \\ - \\ - \end{Bmatrix} \leftarrow \underbrace{\begin{Bmatrix} - \\ - \\ - \\ - \\ - \\ - \end{Bmatrix}}_{6\times1}$$



$$\Delta q^e = [\Gamma_{RAM}] \Delta q^e_{\text{local},i}$$

removing boundary



Atlas

element force increment.

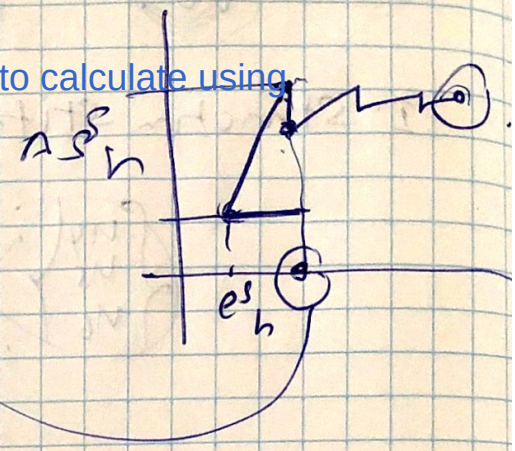
$$\{\Delta Q^e_{i,y}\} = [k^e_{i-1}]\{\Delta q^e_i\} - \{Q_{unb\,i-1}\}$$

shape function.

$$\Delta S^s_h = [N^h]\{\Delta q^e_i\}$$

per element there are few sections. all have to calculate using guass

Sections for integ



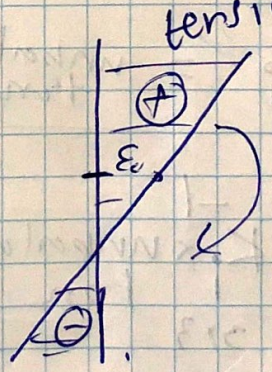
$$\{\Delta e^s_{h,y}\} = [F_{sec}]^{-1}\Delta S^s_h$$

$$e^s_h = e^s_h + \Delta e^s_h$$

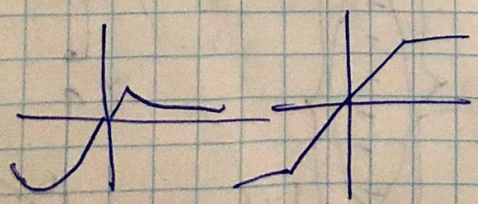
$$S^s_{h,unb\,z} = \Delta S^s_{h,unb\,z-1} - S^s_{h,resi}.$$

$$\Delta e^s_{h,z+1} = k_{sec_z} S^s_{h,unb}$$

(3). $\begin{Bmatrix} \varepsilon_0 \\ k \end{Bmatrix}$



$$\varepsilon_{fib} = \varepsilon_0 - yk.$$



σ_{fib}

$$S^s_{h,res} = \begin{Bmatrix} \Sigma\, \sigma_{fib} A_{fib} \\ \Sigma - \sigma_{fib} A_{fib} y \end{Bmatrix}$$

No :

Date: __/__/____

$$K_{sec} = \sum \begin{bmatrix} E_T A_{fib} & -E_T A_{fib} \\ -E_T A_{fib} & E_T A_{fib}^2 \end{bmatrix}.$$