HW2

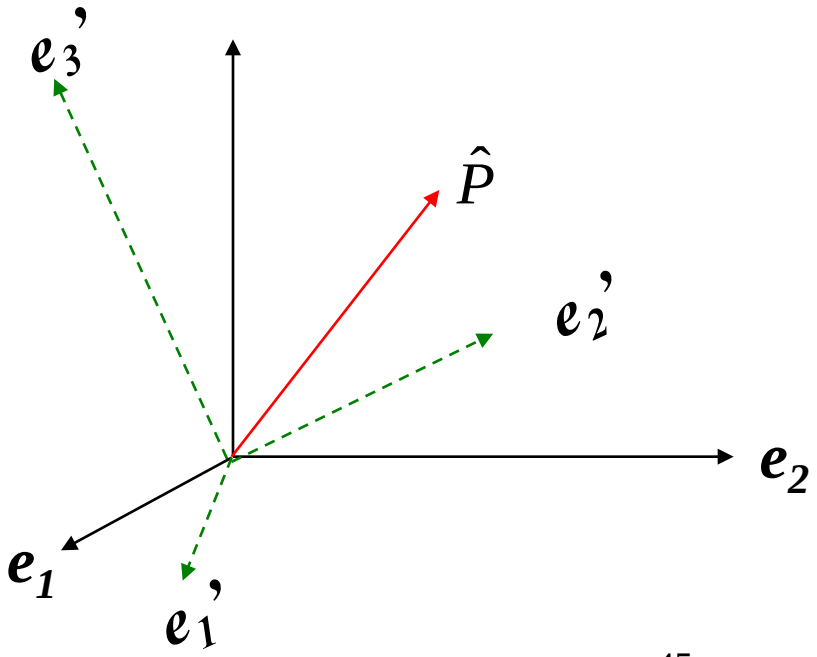
某一位移向量 $\hat{P}$ 於原座標系統為 $\hat{P} = u \cdot \hat{e}_1 + v \cdot \hat{e}_2 + w \cdot \hat{e}_3 (u = 3m; v = 3m; w = 3m)$

請問於旋轉後新座標系統此一位移向量 $\hat{P}'$ 為何？

$$\hat{e}_1' = 0.071 \cdot \hat{e}_1 + 0.816 \cdot \hat{e}_2 + 0.574 \cdot \hat{e}_3$$

$$\hat{e}_2' = -0.584 \cdot \hat{e}_1 - 0.440 \cdot \hat{e}_2 + 0.682 \cdot \hat{e}_3$$

$$\hat{e}_3' = 0.808 \cdot \hat{e}_1 - 0.377 \cdot \hat{e}_2 + 0.454 \cdot \hat{e}_3$$



HW3

Given a stress tensor $\sigma_{ij} = \begin{pmatrix} 1 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 1 \end{pmatrix}$ (GPa)，

Please find：(1) three principal stresses；(2) three principal directions。

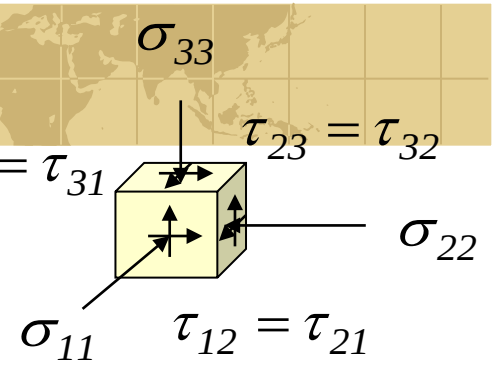
Given a fault plane N-S strike、dip angle 90° (vertical plane)

Please find：(1) Surface traction $T_i^{\hat{n}}$；(2)normal stress；(3)shear stress。

If the stress state of the fault was measured just before the fault slip (shear stress=shear strength), please determine the friction coefficient of the fault ?

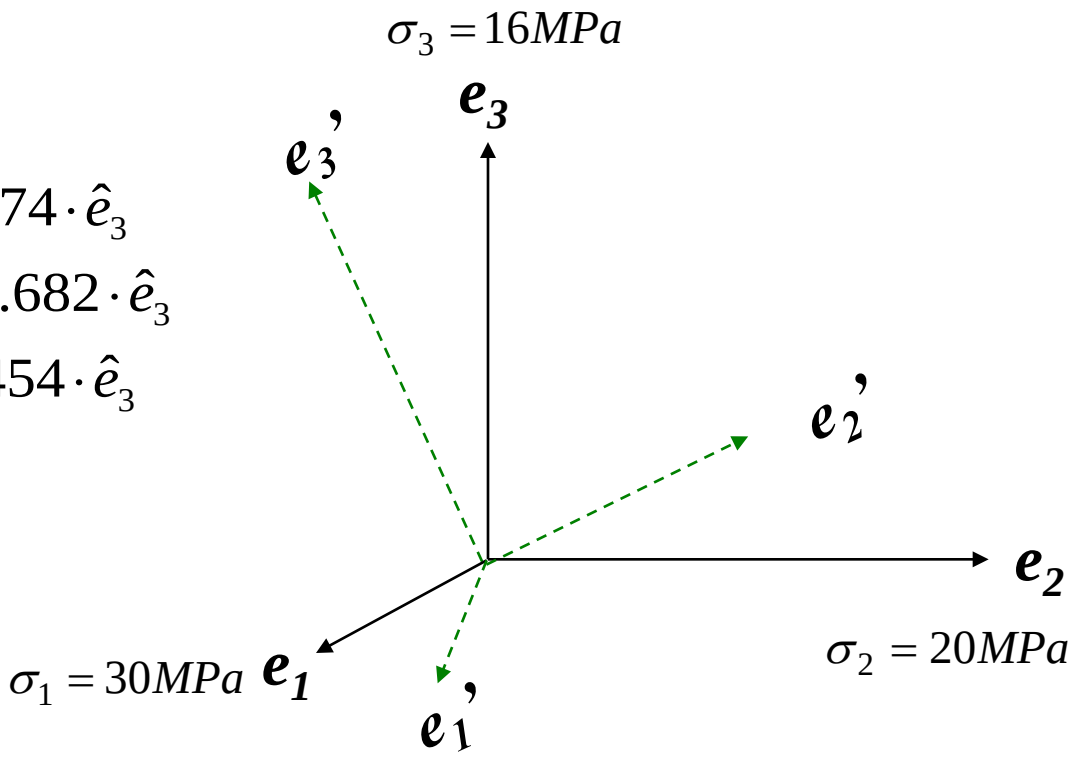
Hint: direction 1 in Eastern-ward, direction 2 in Northern-ward, direction 3 in up-ward, friction coefficient $\mu = \tau_n / \sigma_n$

HW4



Please find the stress tensor in coordinate system e_1'-e_2'-e_3'

$$\hat{e}_1' = 0.071 \cdot \hat{e}_1 + 0.816 \cdot \hat{e}_2 + 0.574 \cdot \hat{e}_3$$
$$\hat{e}_2' = -0.584 \cdot \hat{e}_1 - 0.440 \cdot \hat{e}_2 + 0.682 \cdot \hat{e}_3$$
$$\hat{e}_3' = 0.808 \cdot \hat{e}_1 - 0.377 \cdot \hat{e}_2 + 0.454 \cdot \hat{e}_3$$



Please read section 2.3

大域座標下 $\sigma_{pq} = ?$

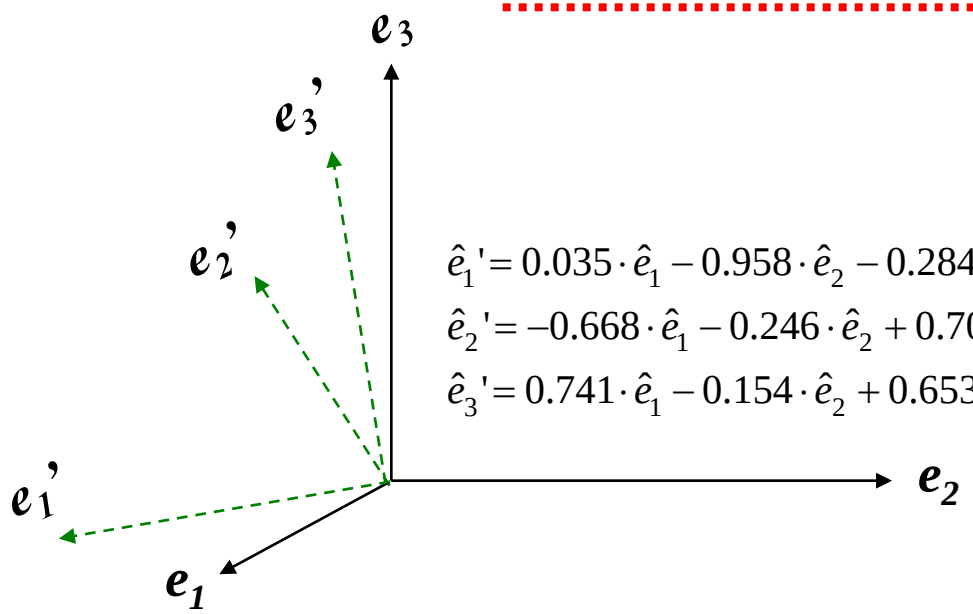
$$\sigma_{jk}' = \begin{bmatrix} 36.6 & 0 & 0 \\ 0 & 16 & 0 \\ 0 & 0 & 12.3 \end{bmatrix} (MPa)$$

$$\ell_{ij} = \hat{e}_i' \cdot \hat{e}_j$$

$$\sigma_{il}' = \ell_{ij} \cdot \sigma_{jk} \cdot \ell_{lk}$$

$$\therefore \ell_{ip} \cdot \sigma_{il}' \cdot \ell_{lq} = \ell_{ip} \cdot \ell_{ij} \cdot \sigma_{jk} \cdot \ell_{lk} \cdot \ell_{lq} = \delta_{pj} \cdot \sigma_{jk} \cdot \delta_{kq} = \sigma_{pq}$$

$$\therefore \sigma_{pq} = \ell_{ip} \cdot \sigma_{il}' \cdot \ell_{lq} \quad \textbf{or} \quad \sigma_{il} = \ell_{ji} \cdot \sigma_{jk}' \cdot \ell_{kl}$$



$$\hat{e}_1' = 0.035 \cdot \hat{e}_1 - 0.958 \cdot \hat{e}_2 - 0.284 \cdot \hat{e}_3$$
$$\hat{e}_2' = -0.668 \cdot \hat{e}_1 - 0.246 \cdot \hat{e}_2 + 0.702 \cdot \hat{e}_3$$
$$\hat{e}_3' = 0.741 \cdot \hat{e}_1 - 0.154 \cdot \hat{e}_2 + 0.653 \cdot \hat{e}_3$$