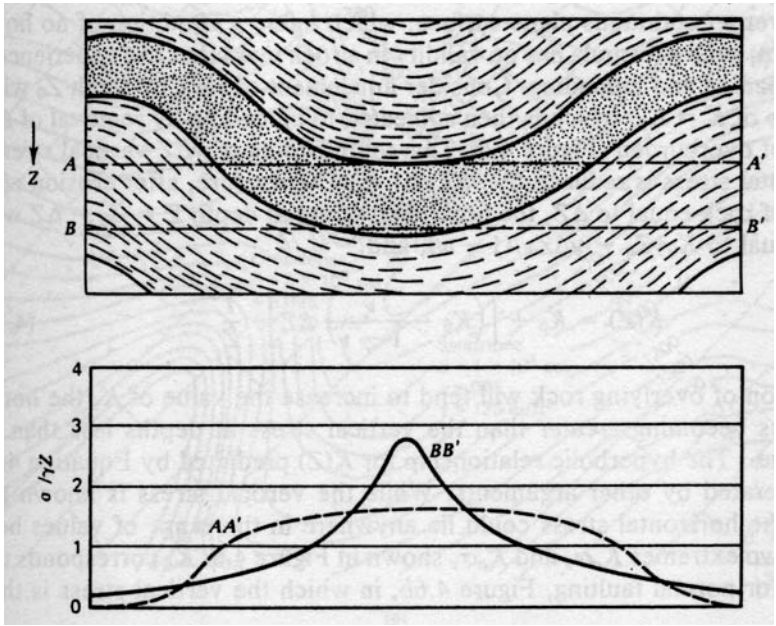
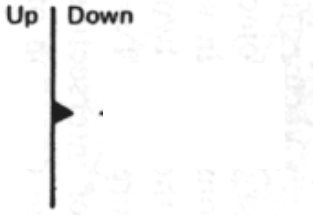
Tectonic stress

- **Thrust faulting and folding**
  - One sub-horizontal stress component significantly greater than both the overburden stress and the other horizontal stress
  - This effect should persist at depth
- **Distinction between erosion effect**
  - Erosion – shallow depth

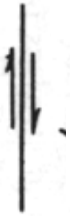


Estimation of the principal directions of stress



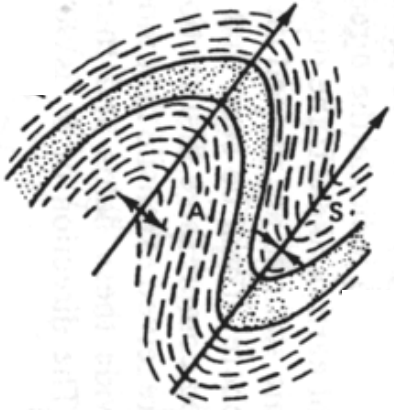
(a) Normal fault

(b) Reverse fault



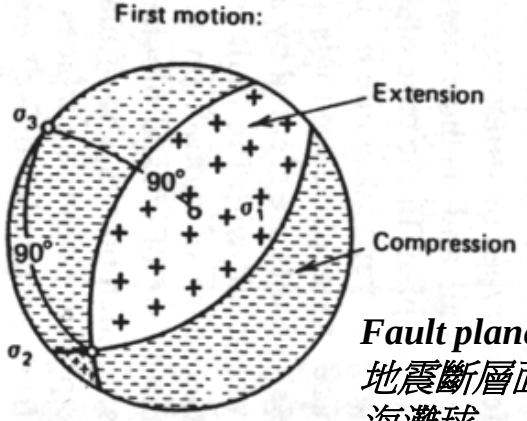
(c) serike slip fault

(d) Dike.



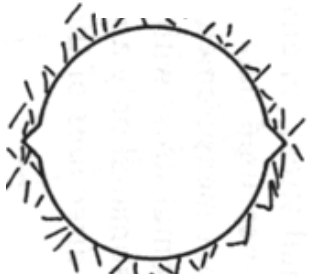
(e) fold

初達波向下，膨脹，白色，最大主應力



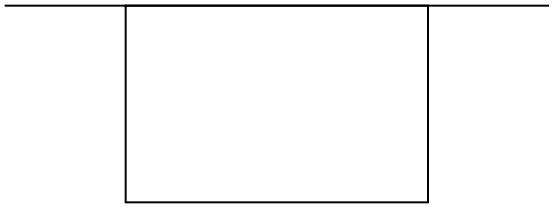
(f)

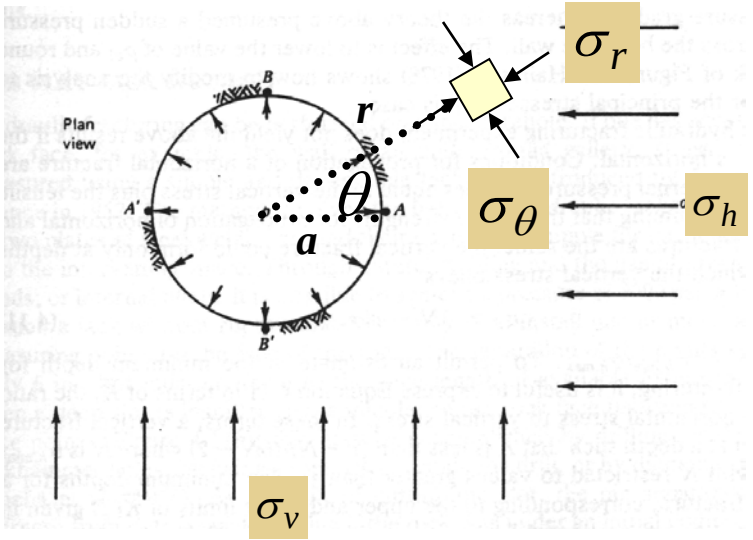
Fault plane solution
地震斷層面解
海灘球



(g) ***Bore-hole breakout***

Induced stress





Kirsch solution (Kirsch,1898)

$$\sigma_r = \frac{\sigma_h + \sigma_v}{2} \cdot (1 - \frac{a^2}{r^2}) + \frac{\sigma_h - \sigma_v}{2} \cdot (1 - \frac{4 \cdot a^2}{r^2} + \frac{3 \cdot a^4}{r^4}) \cdot \cos 2\theta$$

$$\sigma_\theta = \frac{\sigma_h + \sigma_v}{2} \cdot (1 + \frac{a^2}{r^2}) - \frac{\sigma_h - \sigma_v}{2} \cdot (1 + \frac{3 \cdot a^4}{r^4}) \cdot \cos 2\theta$$

$$\tau_{r\theta} = -\frac{\sigma_h - \sigma_v}{2} \cdot (1 + \frac{2 \cdot a^2}{r^2} - \frac{3 \cdot a^4}{r^4}) \cdot \sin 2\theta$$

$$u_r = -\frac{a^2}{2Gr}[\frac{\sigma_h + \sigma_v}{2} + \frac{\sigma_h - \sigma_v}{2} \cdot \{4 \cdot (1 - \nu) - \frac{a^2}{r^2}\} \cdot \cos 2\theta]$$

$$u_\theta = -\frac{a^2}{2Gr}[\frac{\sigma_h - \sigma_v}{2} \cdot \{2 \cdot (1 - 2 \cdot \nu) + \frac{a^2}{r^2}\} \cdot \sin 2\theta]$$

HW3

- 某處地層中主應力方向位於垂直與水平方向，若於垂直應力為**100MPa**，水平應力為**50MPa**處開挖一直徑**10**公尺的隧道，**(1)**請計算於隧道外側岩盤中沿**A,B**與**C**方向上徑向與切向應力以及剪應力值之變化。**(2)**請將**A**點以及沿**A**方向距**A**點兩倍隧道直徑處**(r=25m)** 應力狀態以摩爾圓表示**(3)**請將**B**點以及沿**B**方向距**B**點兩倍隧道直徑處**(r=25m)**應力狀態以摩爾圓表示。
- 若垂直應力與水平應力均為**75MPa**則結果如何**?**
- 若垂直應力為**50MPa**，水平應力為**100MPa**則結果又如何**?**