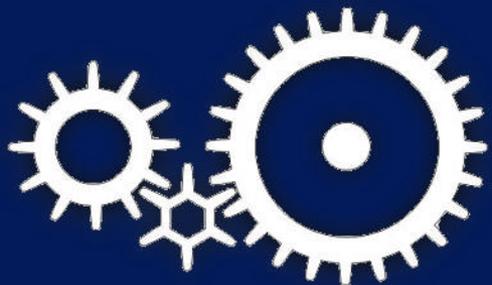


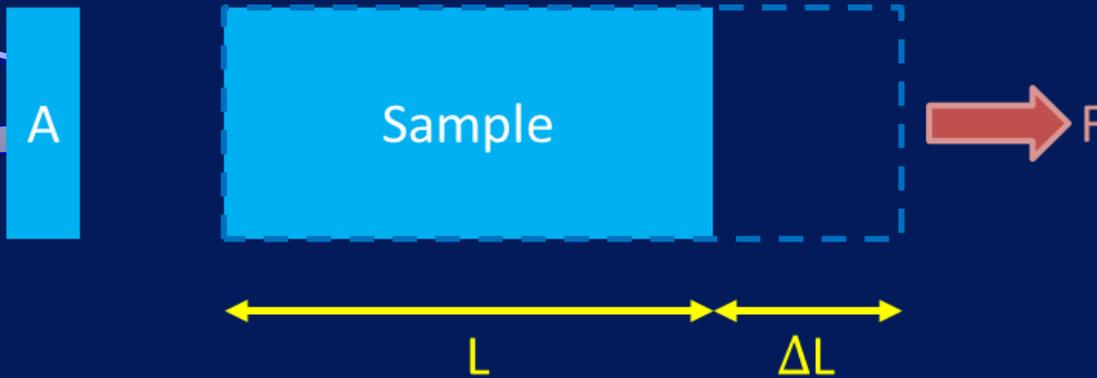
# 應變規(*Strain gauge*)簡介

By 生醫工程分析實驗室

2022/11/14



# 材料性質量測



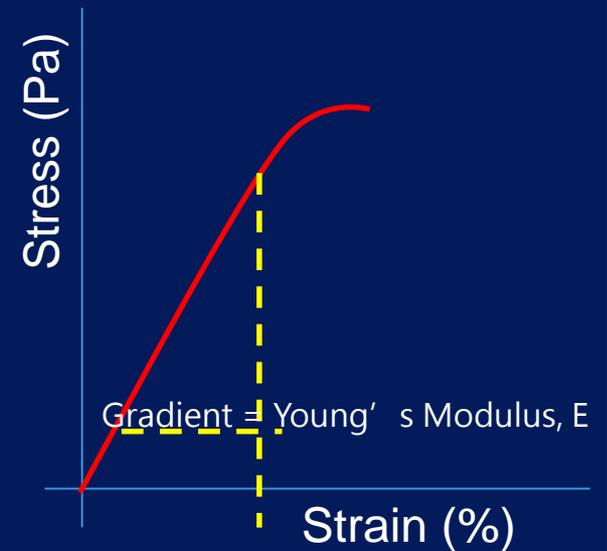
$$\sigma(\text{stress}) = \frac{F}{A}$$

$$E(\text{Young's modulus}) = \frac{\sigma}{\epsilon}$$

$$\epsilon(\text{strain}) = \frac{\Delta L}{L}$$

$$\nu(\text{Poisson ratio}) = \frac{\epsilon_t}{\epsilon_l}$$

$A$ : 試件截面積  $\epsilon_t$ : 橫向應變  $\epsilon_l$ : 縱向應變



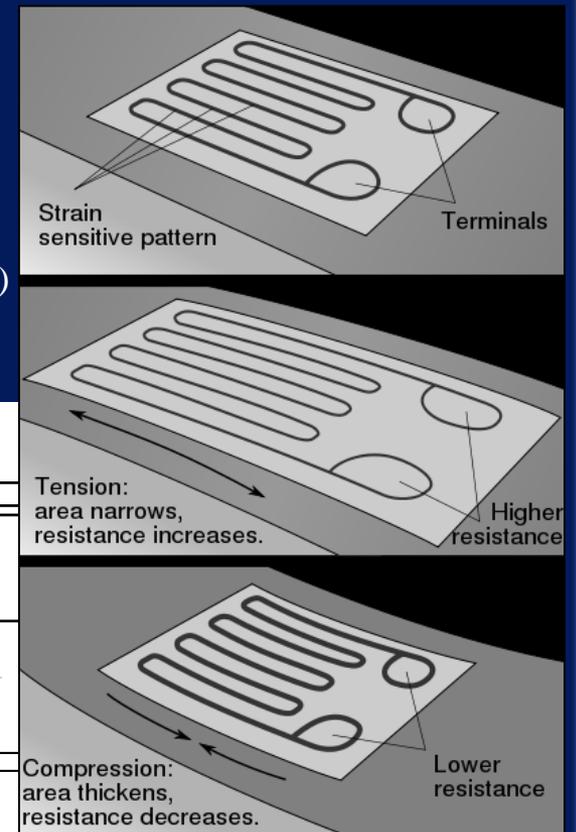
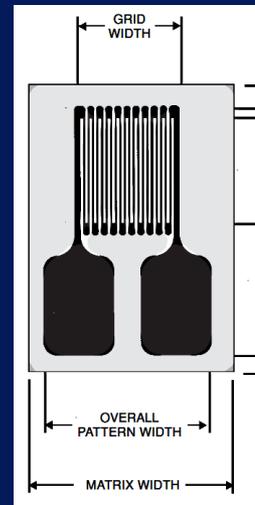
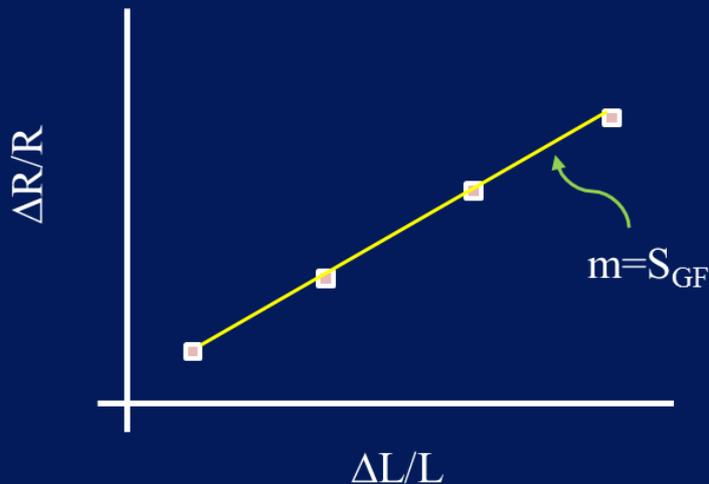
# 應變規(Strain gauge)原理與介紹

- 利用應變規中的金屬導線阻值變化來量測應變量
- 阻值改變量和長度改變量成正比

$$R = \frac{\rho L}{A} \quad (\rho: \text{導線阻抗係數} \quad A: \text{導線截面積})$$

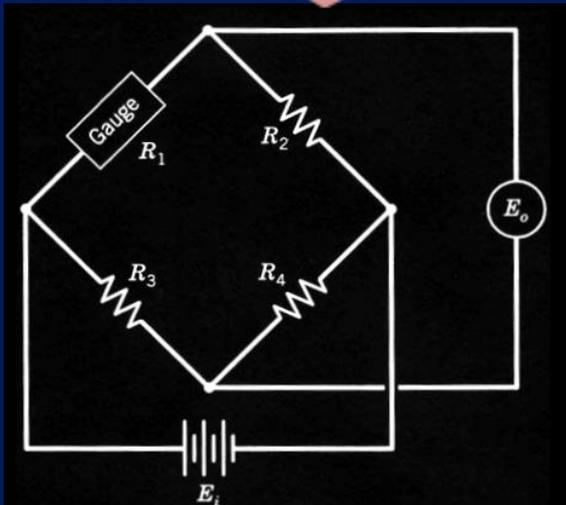
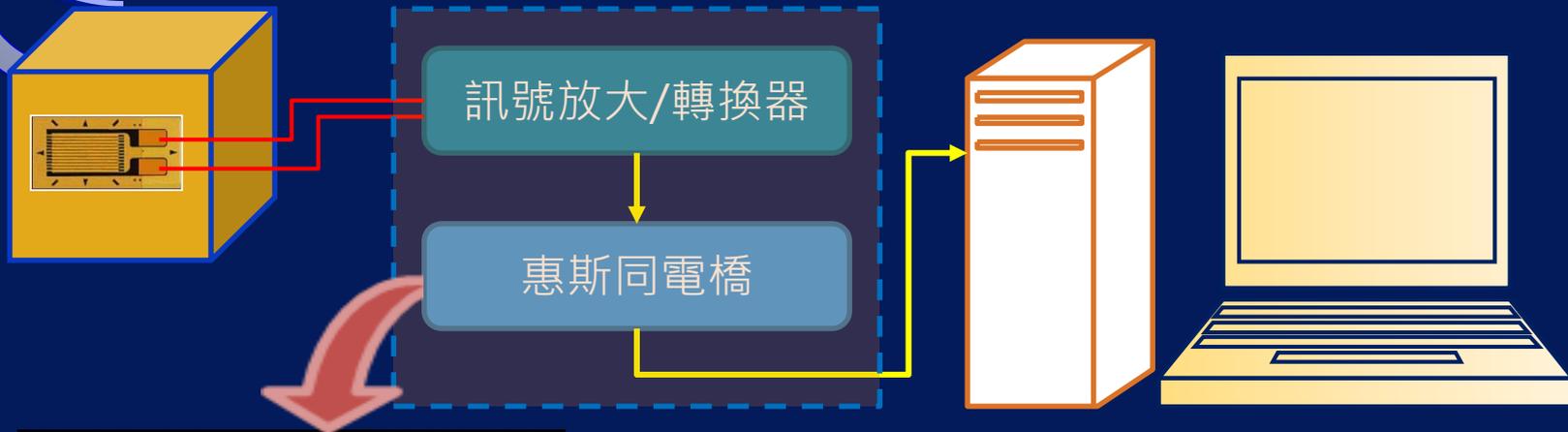
$$\frac{\Delta R}{R} = S_{GF} \cdot \frac{\Delta L}{L} = S_{GF} \cdot \varepsilon \quad (S_{GF}: \text{Gauge factor})$$

(由應變計使用材料的電阻係數決定)



# 應變規(Strain gauge)原理與介紹

應變引起的應變計電阻值約在 $10e-3$ 至 $10e-4\Omega$  (故需利用電橋轉換電阻成電壓信號)



$$E_o = \left( \frac{R_2}{R_1 + R_2} - \frac{R_4}{R_3 + R_4} \right) E_i$$

$E_o$  : Out voltage       $E_i$  : Input voltage

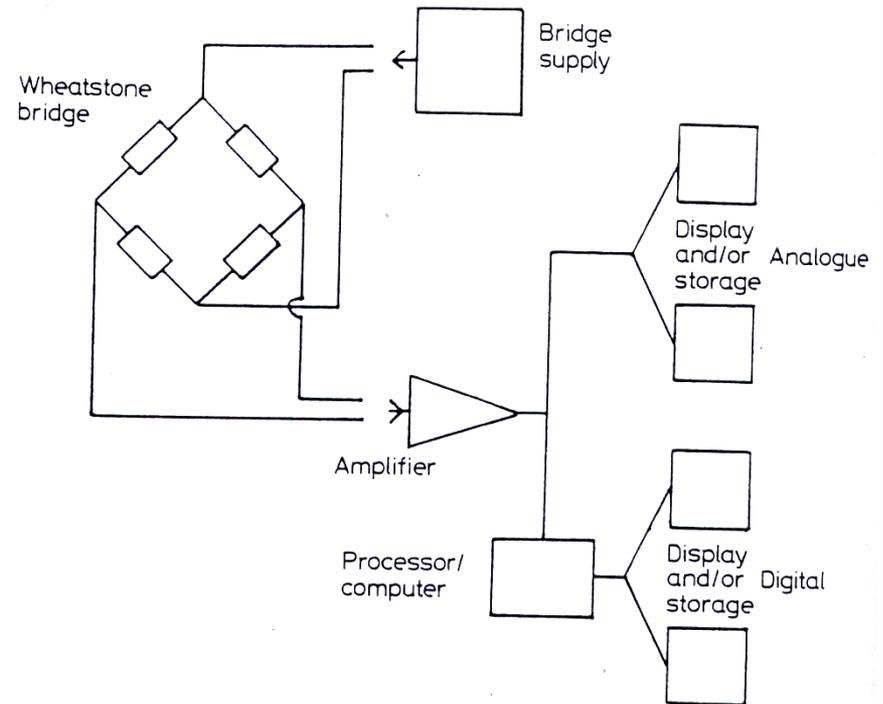
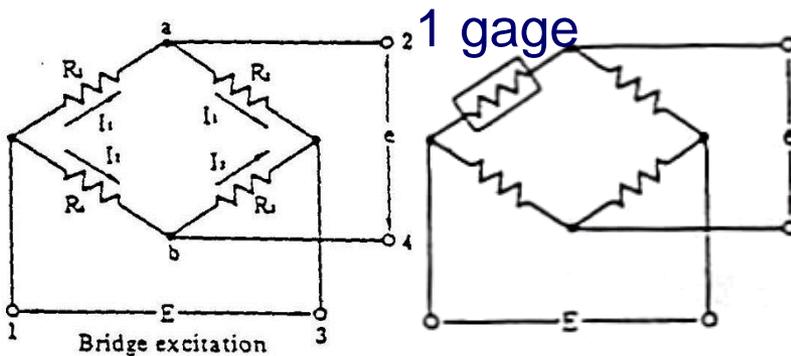
常用電阻值( $R_1$ ) :  $120\Omega, 350\Omega$

惠斯同電橋(Wheatstone Bridge)

CAEB LAB

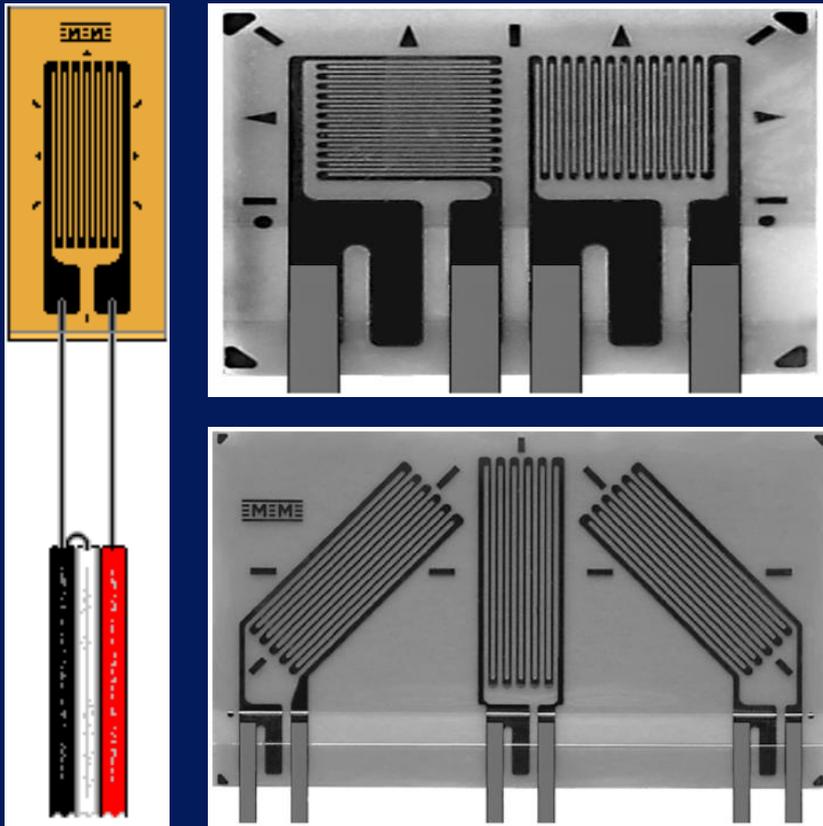
# 應變規(Strain gauge)原理與介紹

- $e$ : 為  $a, b$  電壓差
- $e = S_{GF}E / 4 (\epsilon_1 - \epsilon_2 + \epsilon_3 - \epsilon_4)$
- For 1 gage
  - ◆  $e = S_{GF}E / 4 \epsilon_1$
  - ◆ 只要量出  $e$  即可得知  $\epsilon_1$



# 應變規(Strain gauge)原理與介紹

## ■ 應變規種類



- 依量測方向數量：
  - (a) 單軸應變規
  - (b) 雙軸應變規
  - (c) 多軸應變規

# Thanks for your attention

