

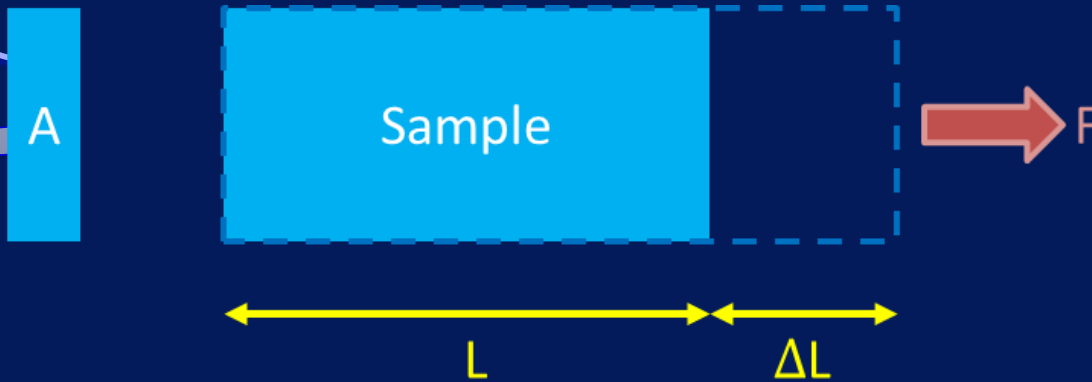
應變規(*Strain gauge*)簡介

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材料性質量測



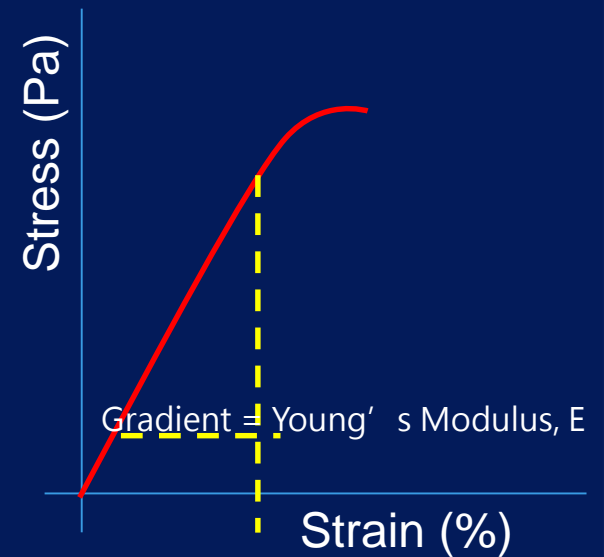
$$\sigma(\text{stress}) = \frac{F}{A}$$

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

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

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

A : 試件截面積 ϵ_t : 橫向應變 ϵ_l : 縱向應變



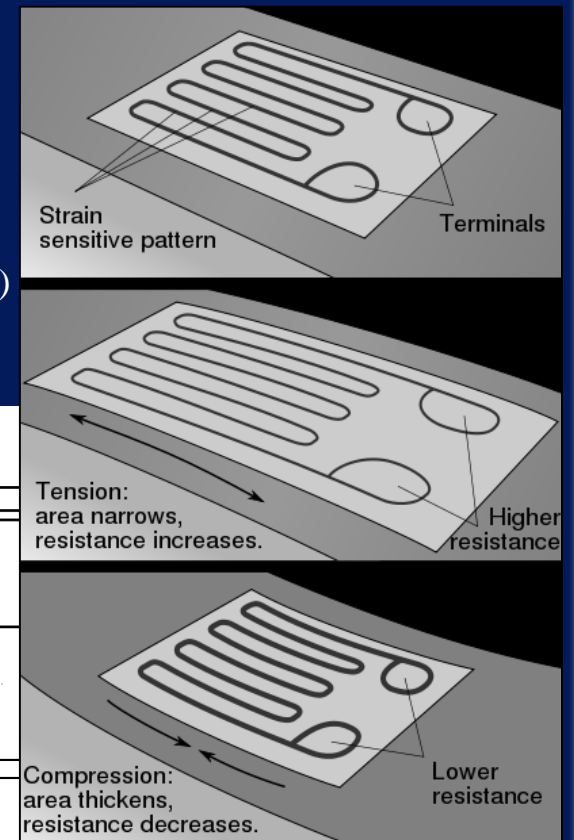
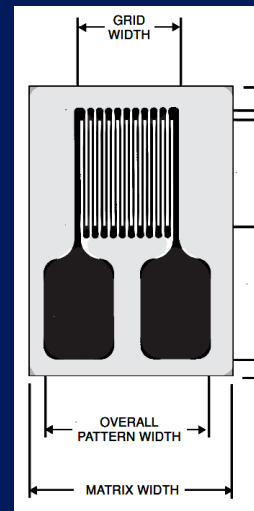
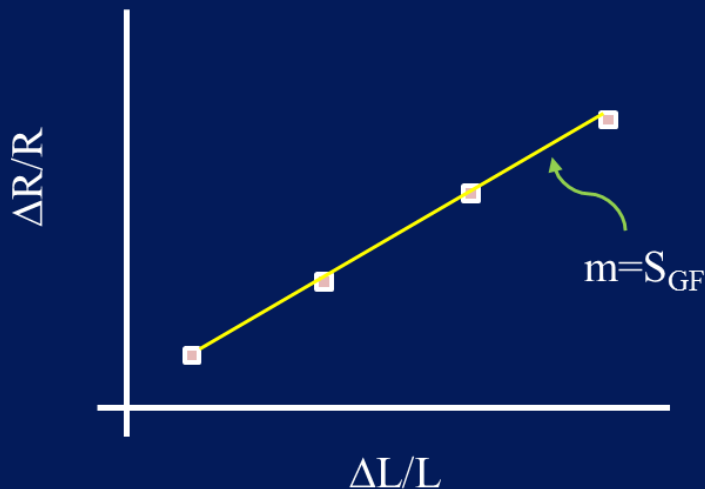
應變規(Strain gauge)原理與介紹

- 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

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

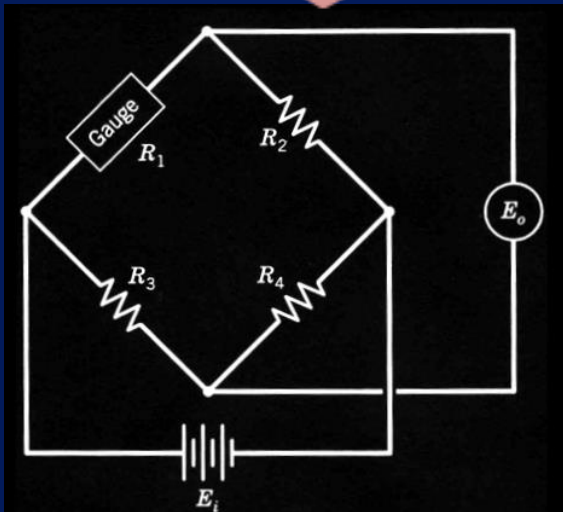
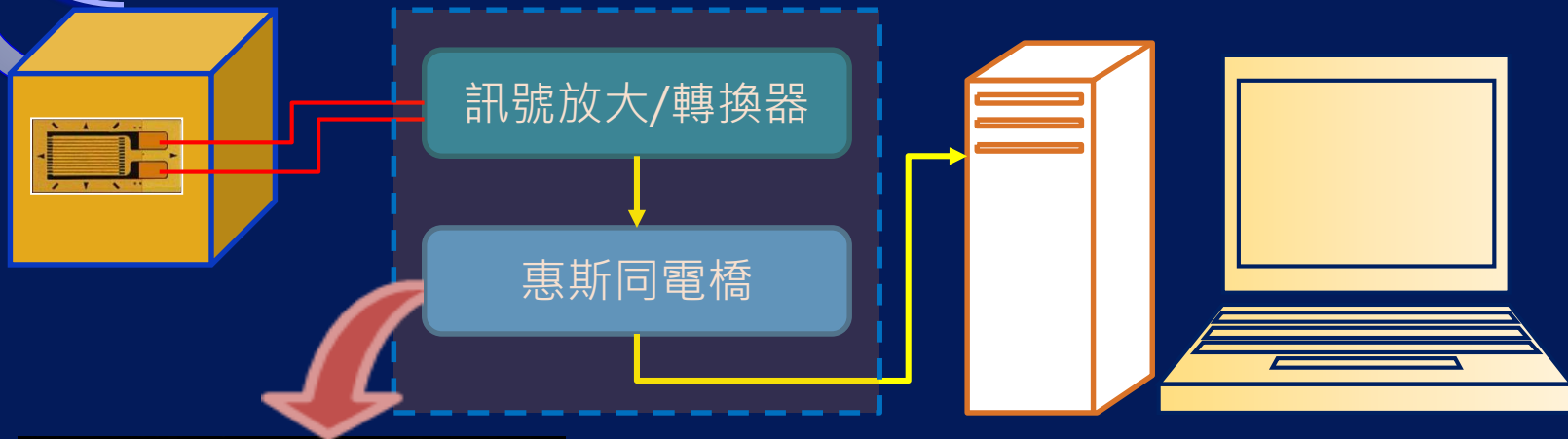
$$\frac{\Delta R}{R} = S_{GF} \cdot \frac{\Delta L}{L} = S_{GF} \cdot \varepsilon \quad (S_{GF}: \text{Gauge factor})$$

(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)



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

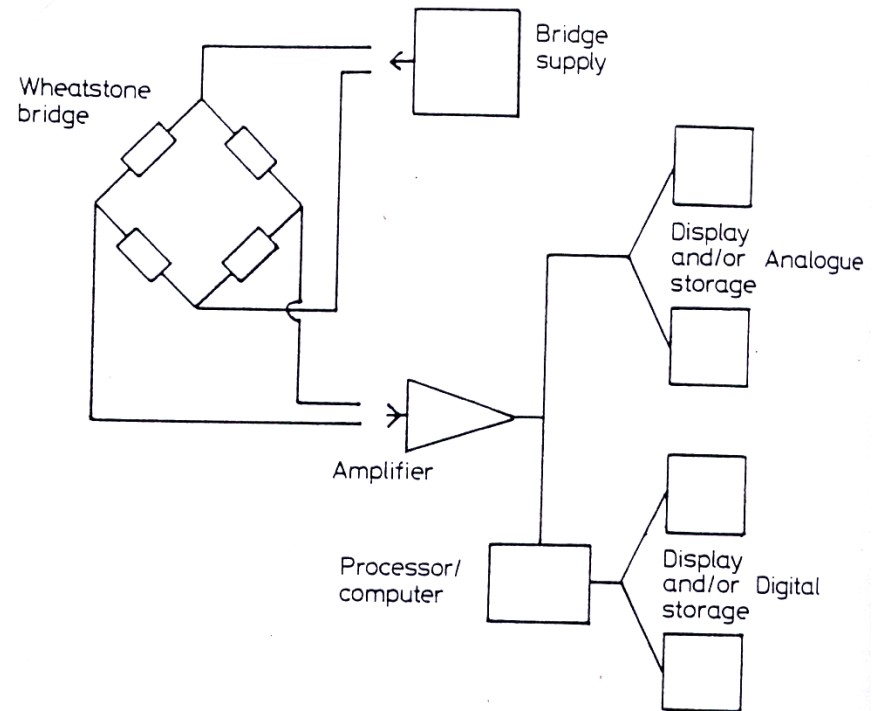
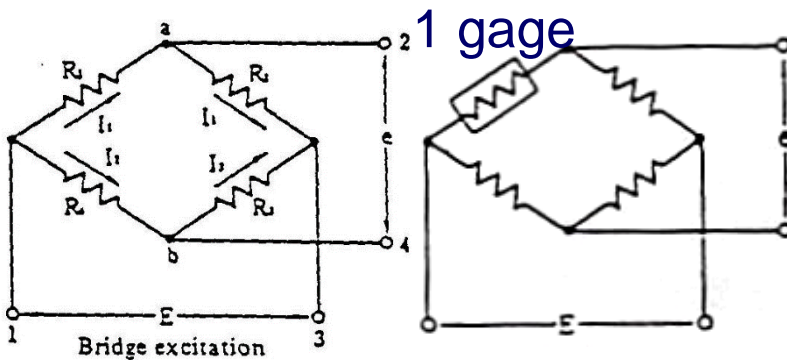
E_o : Out voltage E_i : Input voltage

常用電阻值(R_1) : $120\Omega, 350\Omega$

惠斯同電橋(Wheatstone Bridge)

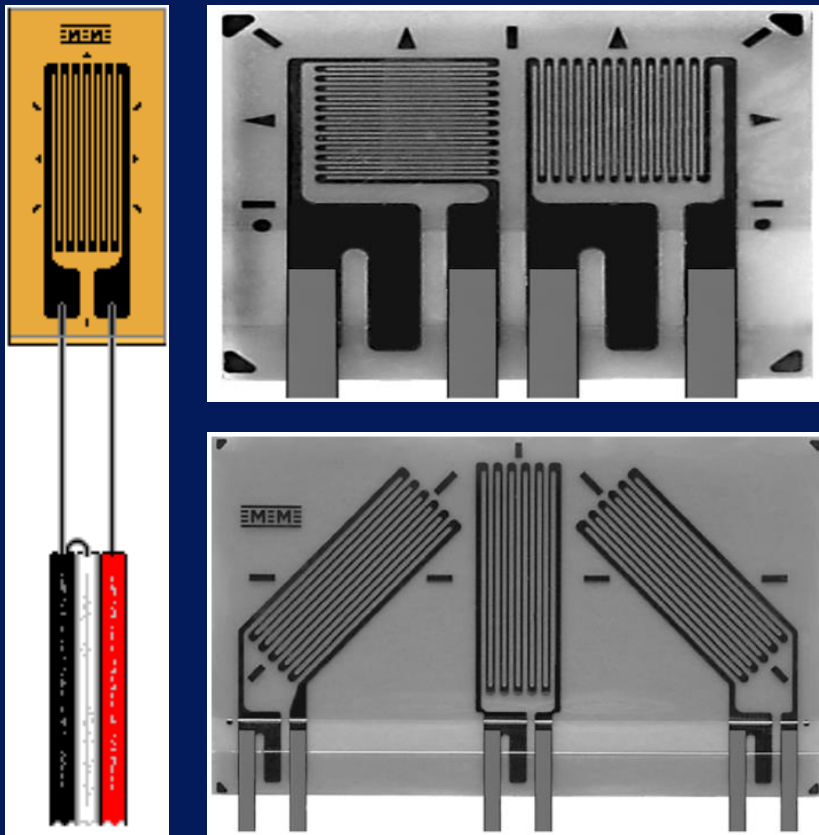
應變規(Strain gauge)原理與介紹

- 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 ϵ_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

