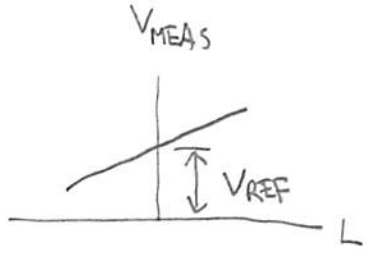
BME 386
PreLab 1 Solns

Total = 30 pts



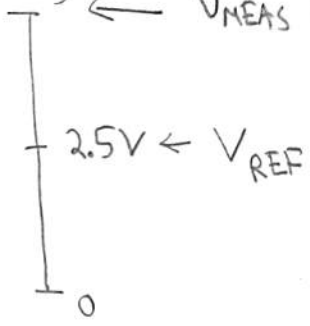
① Just add V_{REF}!

$$V_{MEAS} = V_{REF} + A_d \Delta V$$

$$\boxed{V_{MEAS} = V_{REF} + A_d \, RO \, V_s \frac{L}{L_{Rated}}}$$

② $$\Delta V_{MAX} = RO \cdot V_s \frac{L_{MAX}}{L_{Rated}} = \left(0.8 \tfrac{mV}{V}\right)(5V)\frac{780g}{780g} = \boxed{4\,mV}$$

③



Max $V_{MEAS} < 5V$

$$2.5 + A_d \Delta V_{MAX} < 5V$$

Max allowable gain ↓

$$A_d < \frac{5 - 2.5V}{.004V} = \boxed{625}$$

④ We must not exceed $A_d = 625$, but OK to be a little lower.

Choose $\boxed{A_d = 500}$

⑤ Ideal R_g value: $500 = 1 + \frac{49400}{R_g} \rightarrow R_g = \frac{49400}{500-1} = 99\Omega$

Closest 5% value is $\boxed{100\Omega}$

Actual $A_d = 1 + \frac{49400}{100} = \boxed{495}$

(6) $V_{MEAS} = V_{REF} + A_d RO \cdot V_s \frac{L}{L_{Rated}}$

$$\Rightarrow \boxed{L = \frac{L_{Rated}}{A_d RO \cdot V_s}\left(V_{MEAS} - V_{REF}\right)}$$

(7) $\Delta V_{ADC} = \frac{5-0V}{2^{10}-1} = \underline{\underline{4.89\,mV}} > V_{N,rms} = 1mV$

→ System is limited by <u>vertical resolution</u>!

(8) $\Delta L_{MIN} = \frac{\Delta V_{MIN}}{\frac{\partial V_{MEAS}}{\partial L}} = \frac{\Delta V_{ADC}}{A_d RO \cdot V_s / L_{Rated}}$

$= \frac{4.89\,mV}{495 \cdot (0.8\frac{mV}{V})5V} \cdot 780g$

Actual gain using $R_G = 100\Omega$ $= \boxed{1.93g}$