Slide 25:

(c) With k = 4, $\dfrac{\delta v_o}{v_{ref}} = \dfrac{\delta R}{R} \rightarrow \dfrac{\delta v_o}{v_{ref}} = S_s \varepsilon$

$\varepsilon = \dfrac{\sigma}{E} = \dfrac{6F\ell}{Ebh^2}$; Inertia force $F = \dfrac{W}{g}\ddot{x} = Wa \rightarrow \varepsilon = \dfrac{6W\ell}{Ebh^2}a$

Note: a is in units of g.

$\rightarrow \delta v_o = \dfrac{6W\ell}{Ebh^2} S_s v_{ref} a \rightarrow$ Device sensitivity $\dfrac{\delta v_o}{a} = \dfrac{6W\ell}{Ebh^2} S_s v_{ref}$

(d) Substitute values: $\dfrac{\delta v_o}{a} = \dfrac{6\times 5\times 10^{-3}\times 9.81\times 1\times 10^{-2}\times 200\times 20}{5\times 10^{10}\times 1\times 10^{-3}\times (0.5\times 10^{-3})^2}$ V/g $= 0.94$ V/g

(e) $\dfrac{\varepsilon}{a} = \dfrac{6W\ell}{Ebh^2} = \dfrac{1}{S_s v_{ref}}\dfrac{\delta v_o}{a}$. Substitute values:

$$\frac{\varepsilon}{a} = \frac{0.94}{200\times 20}\text{strain/g} = 2.35\times 10^{-4}\ \varepsilon/\text{g} = 235.0\ \mu\varepsilon/\text{g}$$

$$\text{Yield strain} = \frac{\text{Yield strength}}{E} = \frac{5\times 10^{7}}{5\times 10^{10}} = 1\times 10^{-3}\text{ strain.}$$

$\rightarrow$ Number of g's to yield point $= \dfrac{1\times 10^{-3}}{2.35\times 10^{-4}}\text{g} = 4.26\text{ g}$

(f) Corresponding voltage = 0.94 × 4.26 V = 4.0 V $\rightarrow$ Amplifier gain = 10.0/4.0 = 2.25.

(g) In tension, strain changes (and corresponding resistance changes) in all 4 arms will have the same sign $\rightarrow$ compensated.
In lateral bending, changes in A and C will have the same sign and the changes in *B* and *D* will have the opposite sign $\rightarrow$ compensated