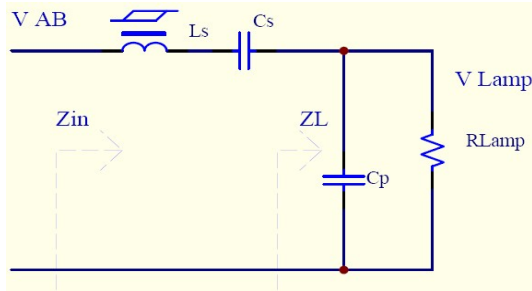


燈管 R-G 值推導



電路增益為 $\frac{V_{Lamp}}{V_{AB}} = \frac{Z_L}{Z_{in}}$

$$Z_L = \frac{\frac{R_{Lamp}}{j\omega_s C_p}}{R_{Lamp} + \frac{1}{j\omega_s C_p}} = \frac{R_{Lamp}}{1 + j\omega_s C_p R_{Lamp}}$$

$$\begin{aligned} Z_{in} &= \frac{1}{j\omega_s C_s} + j\omega_s L_s + \frac{R_{Lamp}}{1 + j\omega_s C_p R_{Lamp}} \\ &= \frac{(1 + j\omega_s C_p R_{Lamp}) + j\omega_s L_s [j\omega_s C_s (1 + j\omega_s C_p R_{Lamp})] + j\omega_s C_s R_{Lamp}}{j\omega_s C_s (1 + j\omega_s C_p R_{Lamp})} \end{aligned}$$

$$\frac{V_{Lamp}}{V_{AB}} = M = \frac{\frac{R_{Lamp}}{1 + j\omega_s C_p R_{Lamp}}}{\frac{(1 + j\omega_s C_p R_{Lamp}) + j\omega_s L_s [j\omega_s C_s (1 + j\omega_s C_p R_{Lamp})] + j\omega_s C_s R_{Lamp}}{j\omega_s C_s (1 + j\omega_s C_p R_{Lamp})}}$$

從 Z_L 看進去則 $C_s \gg C_p \gg C_{eq}$ ，先設 $C_s = nC_p$ 。

$$M = \frac{1}{\left(1 + \frac{C_p}{nC_p} - \omega_s^2 L_s C_p\right) + j\left(\frac{\omega_s L_s}{R_{Lamp}} - \frac{1}{\omega_s nC_p R_{Lamp}}\right)}$$

設諧振頻率剛好為 $\omega_o = \frac{1}{\sqrt{L_s C_p}}$ ， $Q = \frac{R_{Lamp}}{\sqrt{\frac{L_s}{C_p}}}$ ， $Z_o = \sqrt{\frac{L_s}{C_p}} = 2\pi f_o L_s = \frac{1}{2\pi f_o C_p}$ 則

$$|M| = \frac{1}{\left[1 + \frac{1}{n} - \left(\frac{\omega_s}{\omega_o}\right)^2\right]^2 + \frac{1}{Q^2} \left(\frac{\omega_s}{\omega_o} - \frac{\omega_o}{n\omega_s}\right)^2}, \text{ 設 } x = \frac{\omega_s}{\omega_o}$$

$$|M| = \frac{1}{\left[1 + \frac{1}{n} - (x)^2\right]^2 + \frac{1}{Q^2} \left(x - \frac{1}{n \cdot x}\right)^2}$$