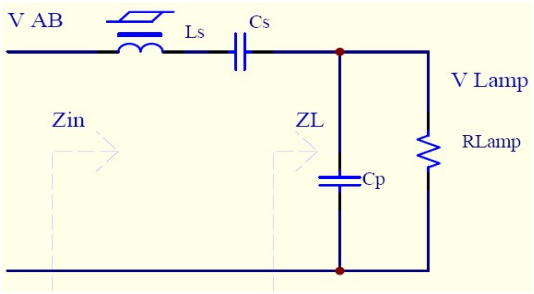
燈管 R-G 值推導



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

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

$$Z_{in}=\frac{1}{j\omega_s C_s}+j\omega_s L_s+\frac{R_{Lamp}}{1+j\omega_s C_p R_{Lamp}}$$

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

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

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

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

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

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

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