# 品质因数
# Quality Factor

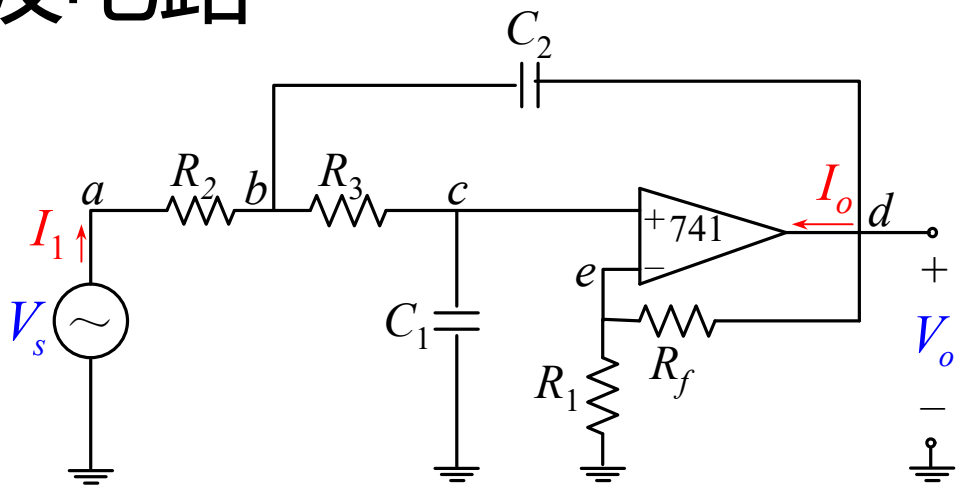
# 品质因数

- 二阶有源RC滤波电路
  - 低通/高通/带通
- RLC谐振回路
  - 串联/并联
- 元件
  - 电感/电容

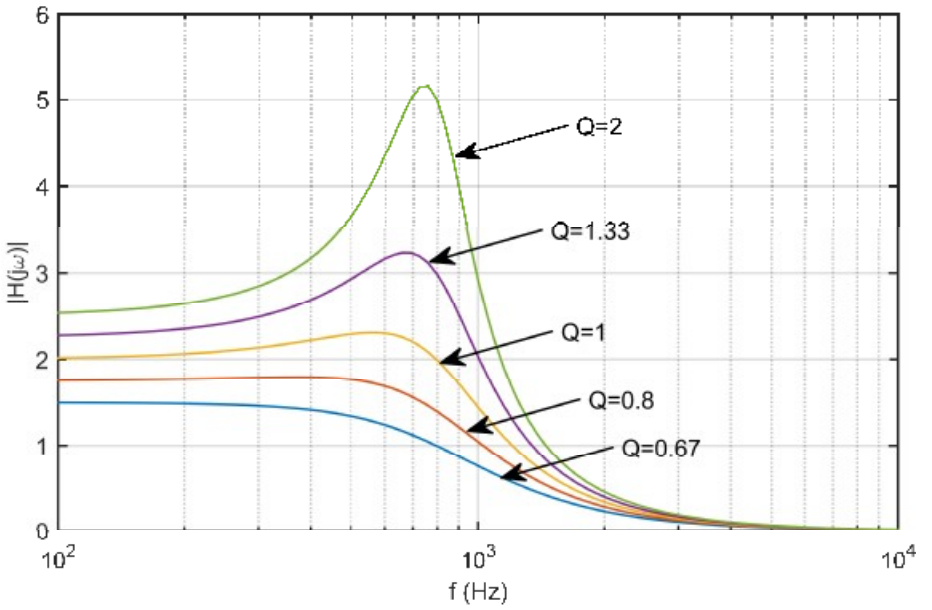
# 二阶低通有源滤波电路

$$\mu = 1 + \frac{R_f}{R}$$

$$Q = 1/(3-\mu)$$



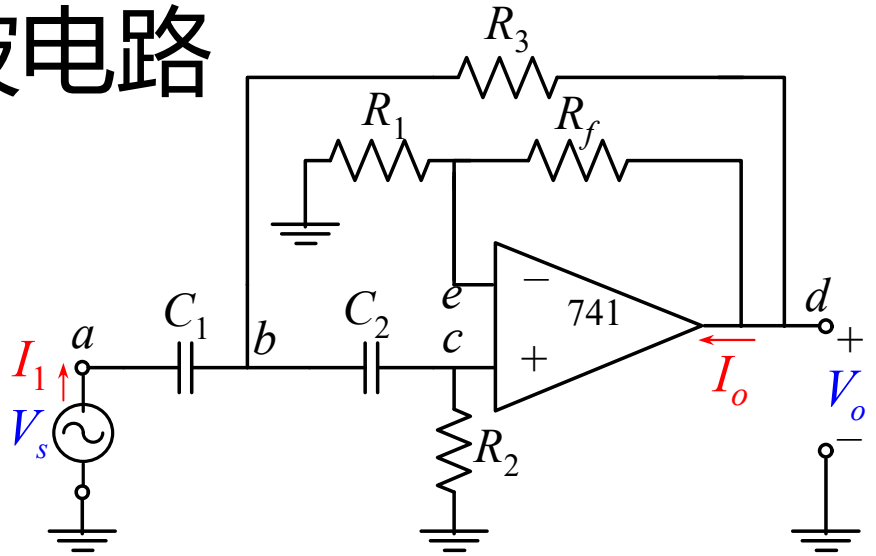

**Q=0.707，平坦度最大**



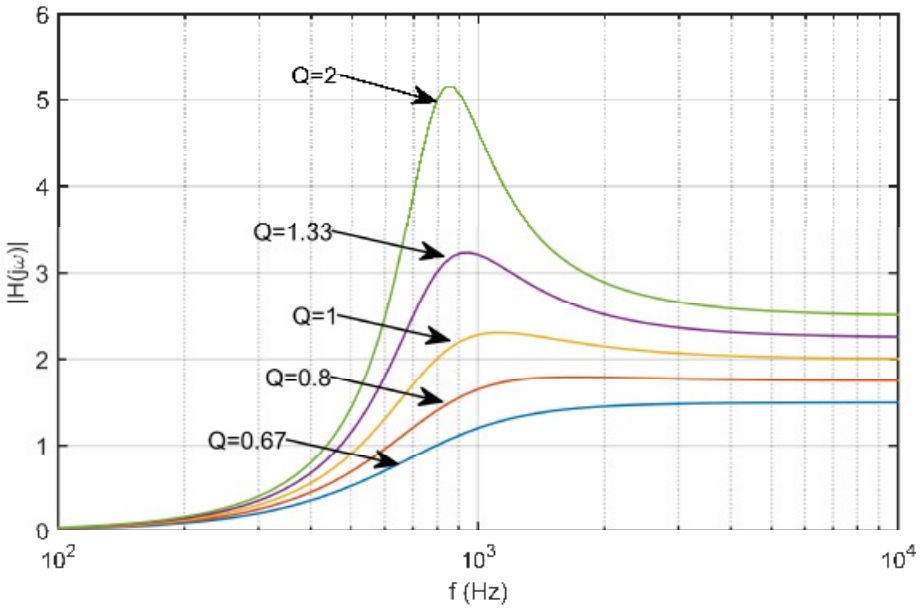
# 二阶高通有源滤波电路

$$\mu = 1 + \frac{R_f}{R}$$

$$Q = 1/(3-\mu)$$



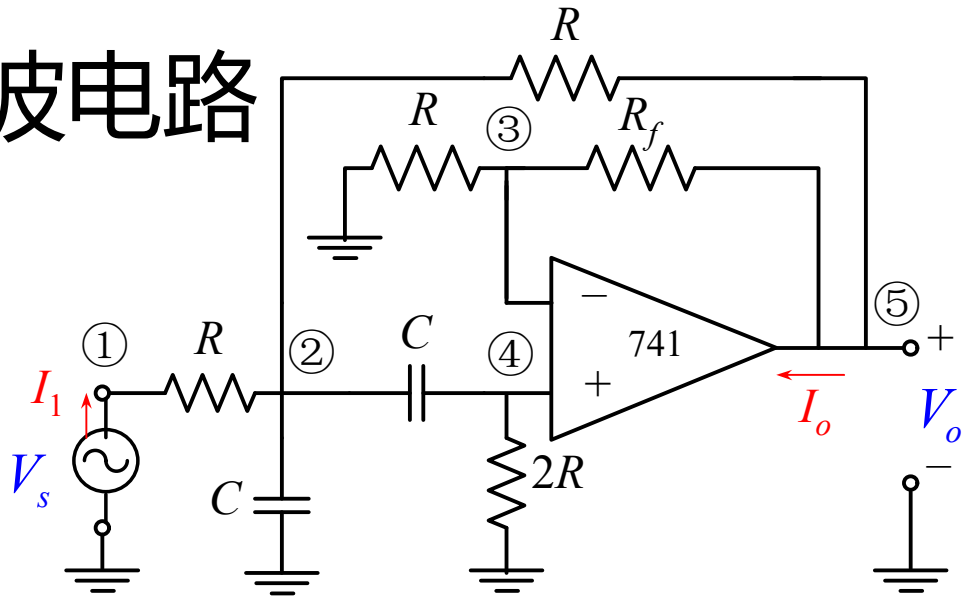

**Q=0.707，平坦度最大**



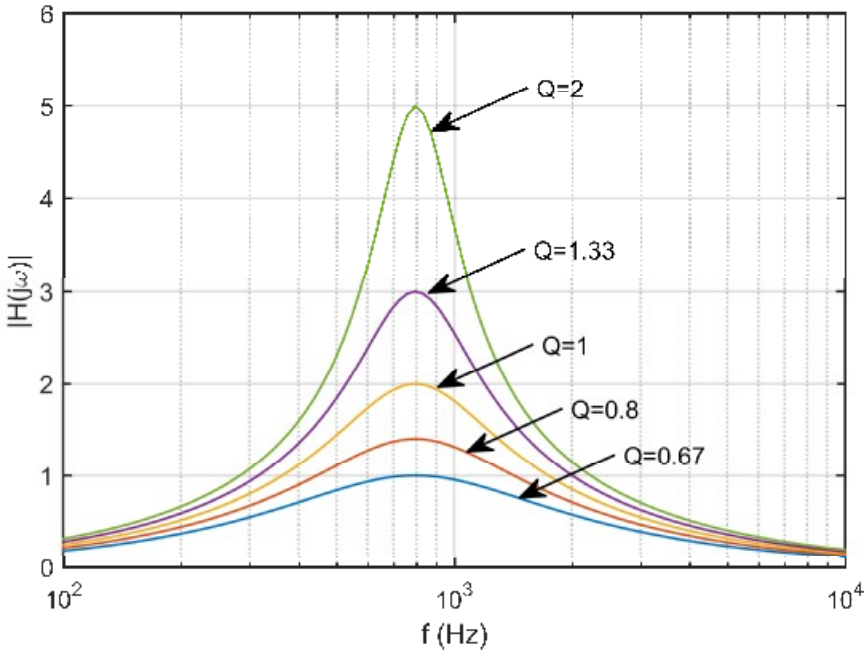
# 二阶带通有源滤波电路

$$\mu = 1 + \frac{R_f}{R}$$

$$Q = 1/(3-\mu)$$



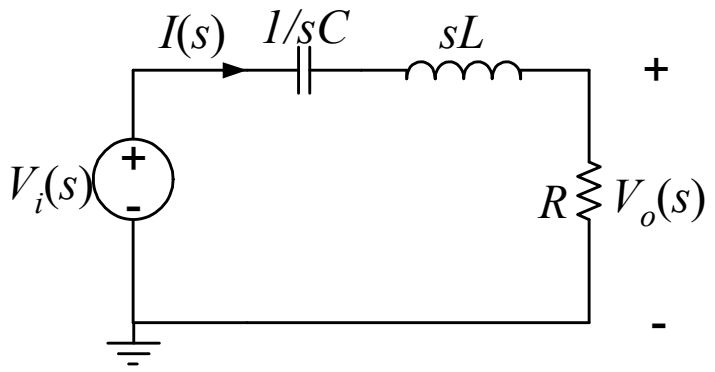

**Q值越大，**
**带宽越窄，频率选择性越好**



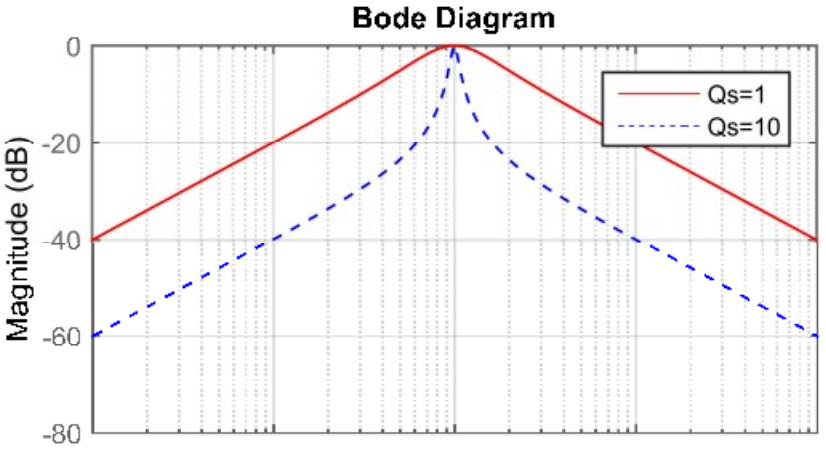
# RLC串联电路

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q_s = \frac{\omega_0 L}{R} = \frac{1}{\omega_0 RC}$$



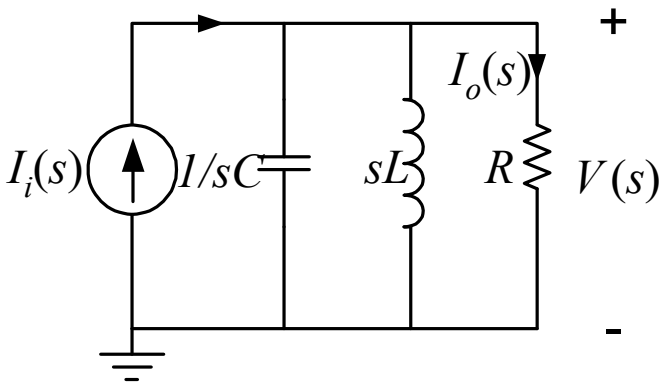

**Q值越大，**
**带宽越窄，频率选择性越好**



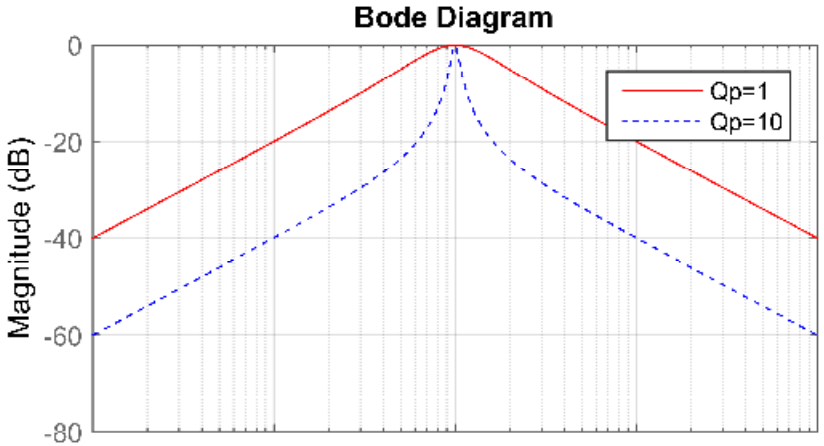
# RLC并联电路

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q_p = \omega_0 CR = \frac{R}{\omega_0 L}$$

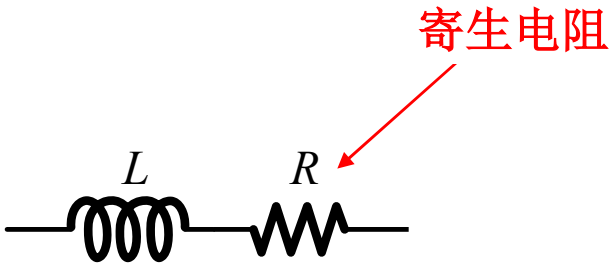



**Q值越大，**
**带宽越窄，频率选择性越好**



# 电感

$$Q = \frac{\omega L}{R}$$



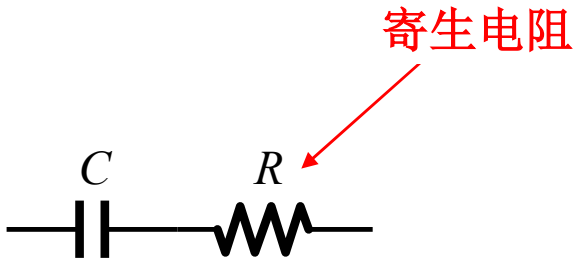

**Q值越大，损耗越小**

$$Z(\omega) = j\omega L + R$$

$$Q = \left| \frac{\mathrm{Im}(Z(\omega))}{\mathrm{Re}(Z(\omega))} \right|$$

# 电容

$$Q = \frac{1}{\omega CR}$$




**Q值越大，损耗越小**

$$Z(\omega) = \frac{1}{j\omega C} + R$$

$$Q = \left| \frac{\mathrm{Im}(Z(\omega))}{\mathrm{Re}(Z(\omega))} \right|$$