NETWORK ANALYSIS AND SYNTHESIS

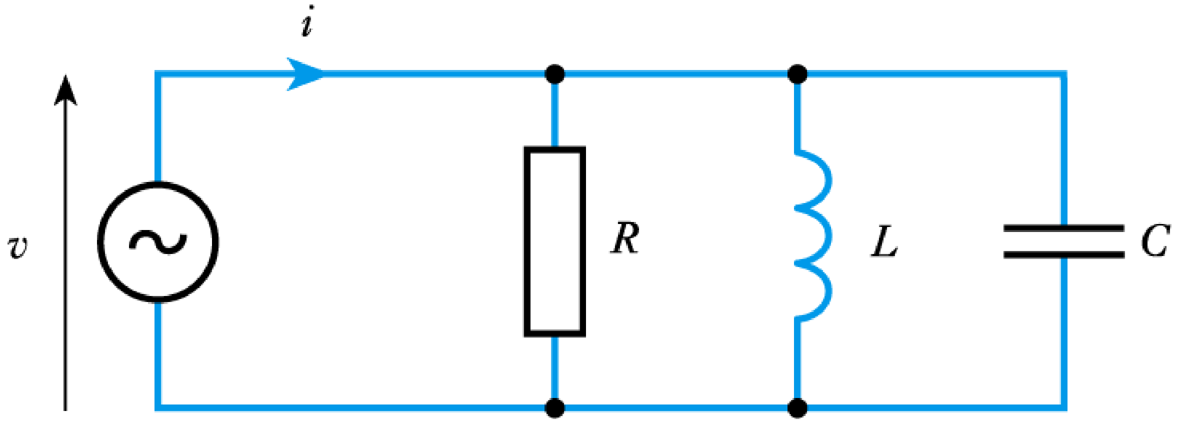
- The series *RLC* circuit is an **acceptor circuit**
  - the narrowness of bandwidth is determined by the Q

$$\text{Quality factor } Q = \frac{\text{Resonant frequency}}{\text{Bandwidth}} = \frac{f_o}{B}$$

  - combining this eq… n the earlier one gives

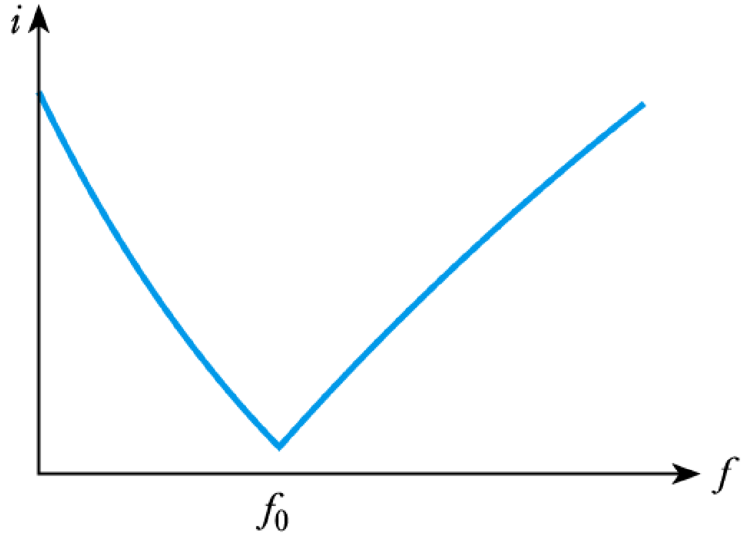
$$B = \frac{R}{2\pi L}\ \text{Hz}$$

- **Parallel *RLC* circuits**



– as before $\omega_o = \frac{1}{\sqrt{LC}}$ $f_o = \frac{1}{2\pi\sqrt{LC}}$

- The parallel arrangement is a **rejector circuit**
  - in the **parallel resonant circuit**, the *impedance* is at a maximum at resonance
  - the *current* is at a minimum at resonance
  - in this circuit



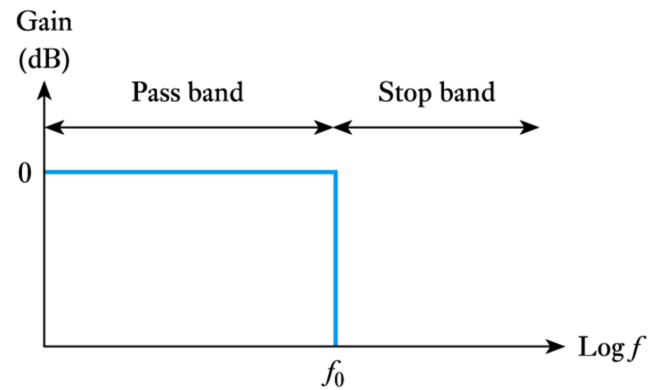
$$Q = R\sqrt{\left(\frac{C}{L}\right)}$$

$$B = \frac{1}{2\pi RC}\ \text{Hz}$$

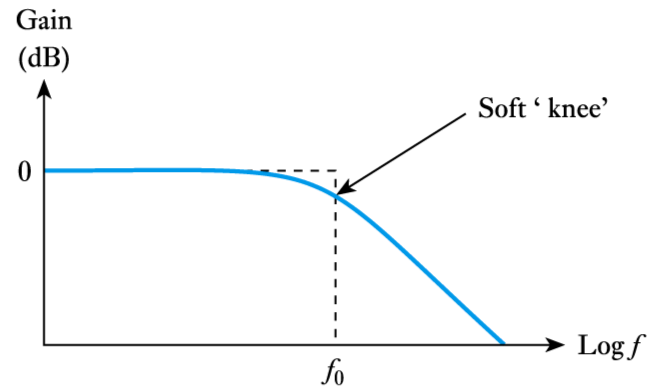
Filters

- ***RC* Filters**
- The *RC* networks considered earlier are **first-order** or **single-pole** filters
  - these have a maximum roll-off of 6 dB/octave
  - they also produce a maximum of 90° phase shift
- Combining multiple stages can produce filters with a
  greater ultimate roll-off rates (12 dB, 18 dB, etc.)
  but such filters have a very soft ‘knee’

- An ideal filter would have constant gain and zero phase shift for frequencies within its **pass band**, and zero gain for frequencies outside this range
(its **stop band**)
- Real filters do not have these idealised characteristics



(a) An ideal low-pass filter



(b) A multi-stage *RC* filter

THANKS….

Queries Please…