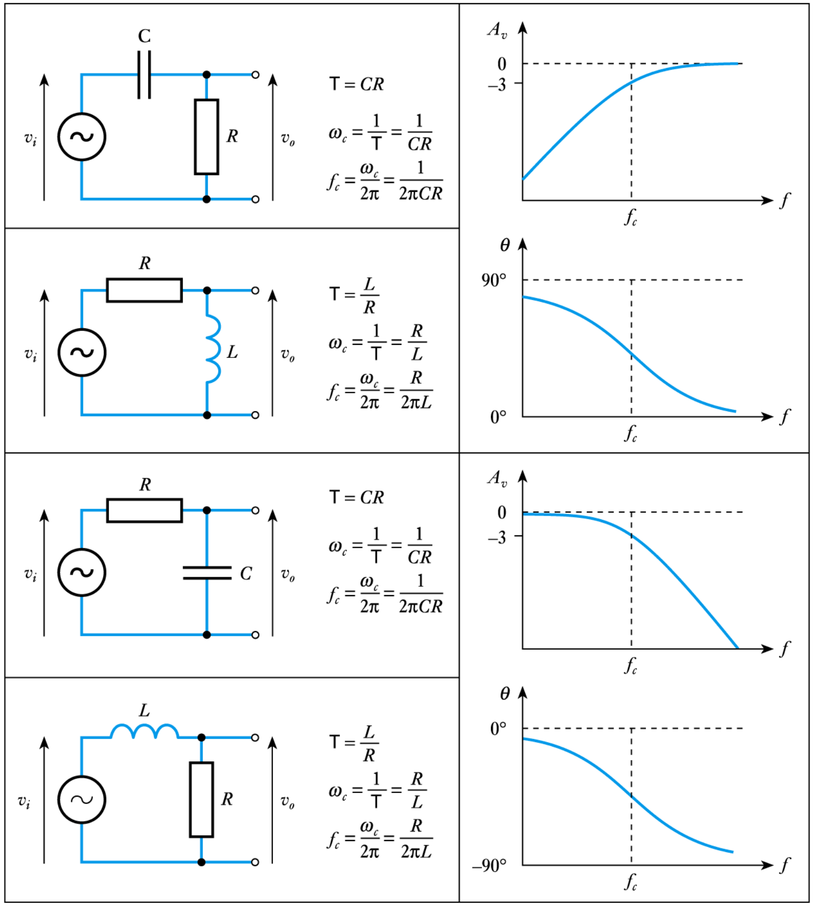
NETWORK ANALYSIS AND SYNTHESIS

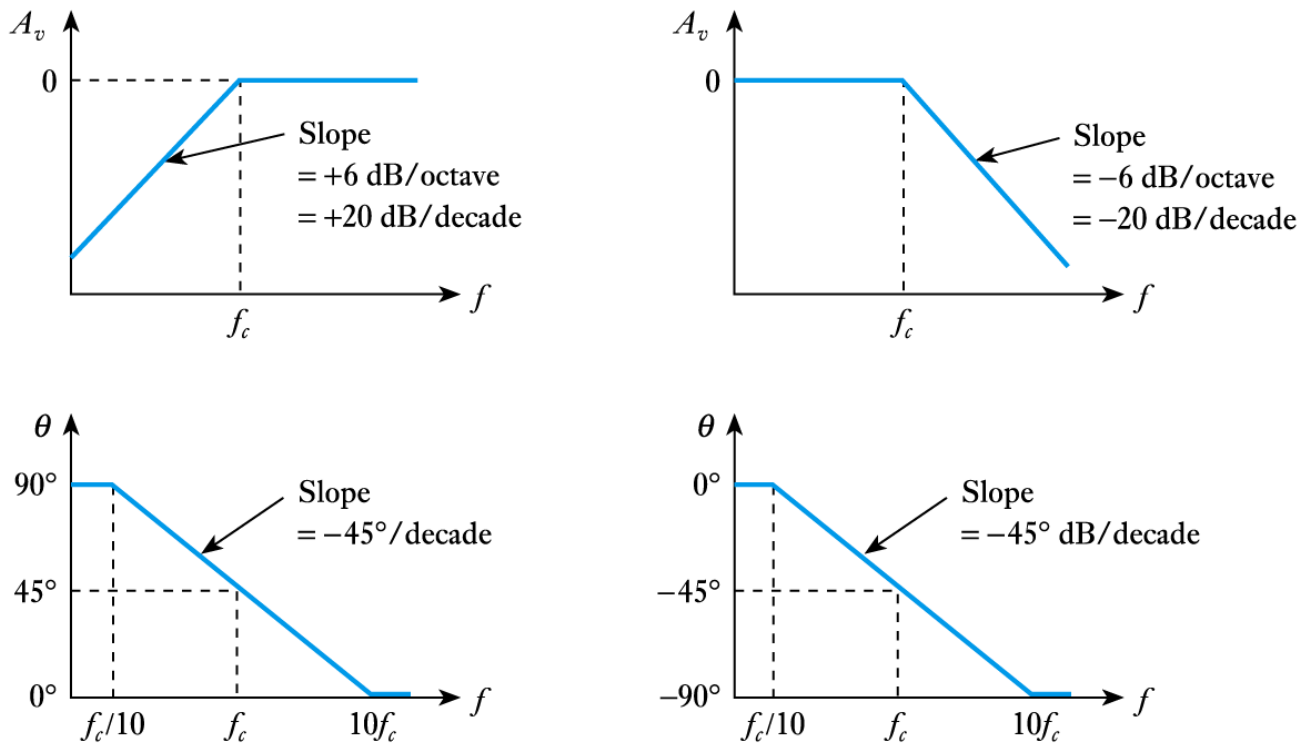
A Comparison of *RC* and *RL* Networks

- Circuits using RC and RL techniques have similar characteristics
  - for a more detailed comparison, see **Figure 17.10** in the course text



Bode Diagrams

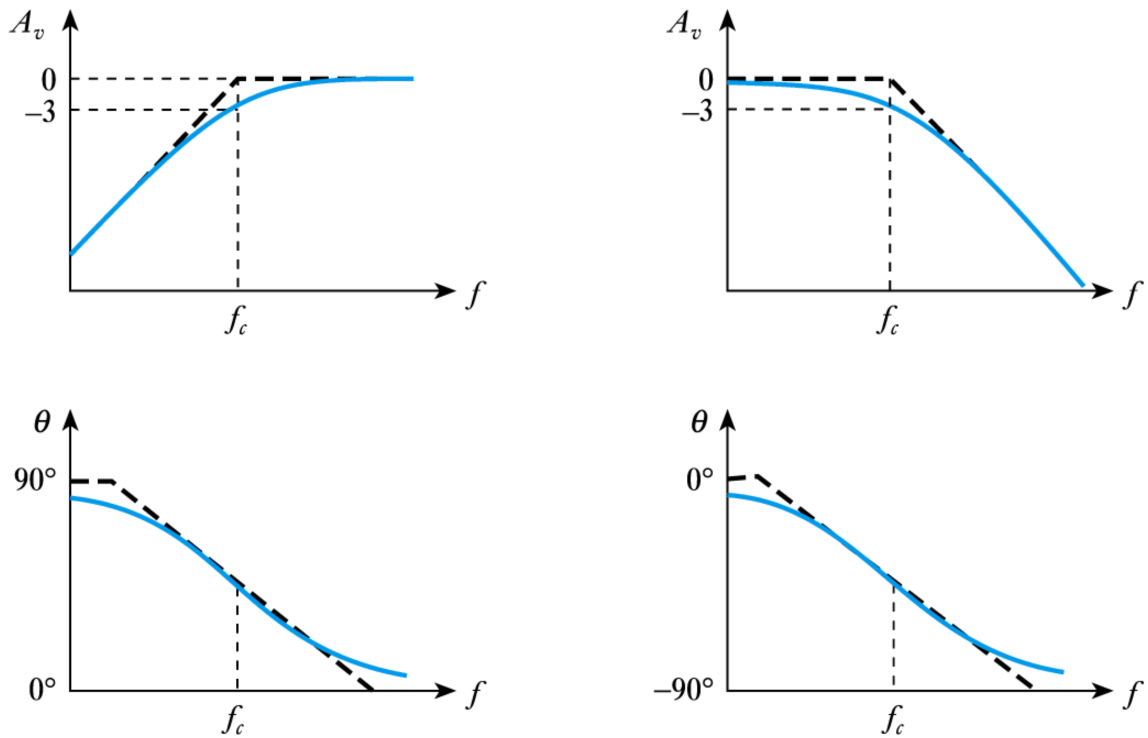
- Straight-line approximations



(a) High-pass circuit

(b) Low-pass circuit

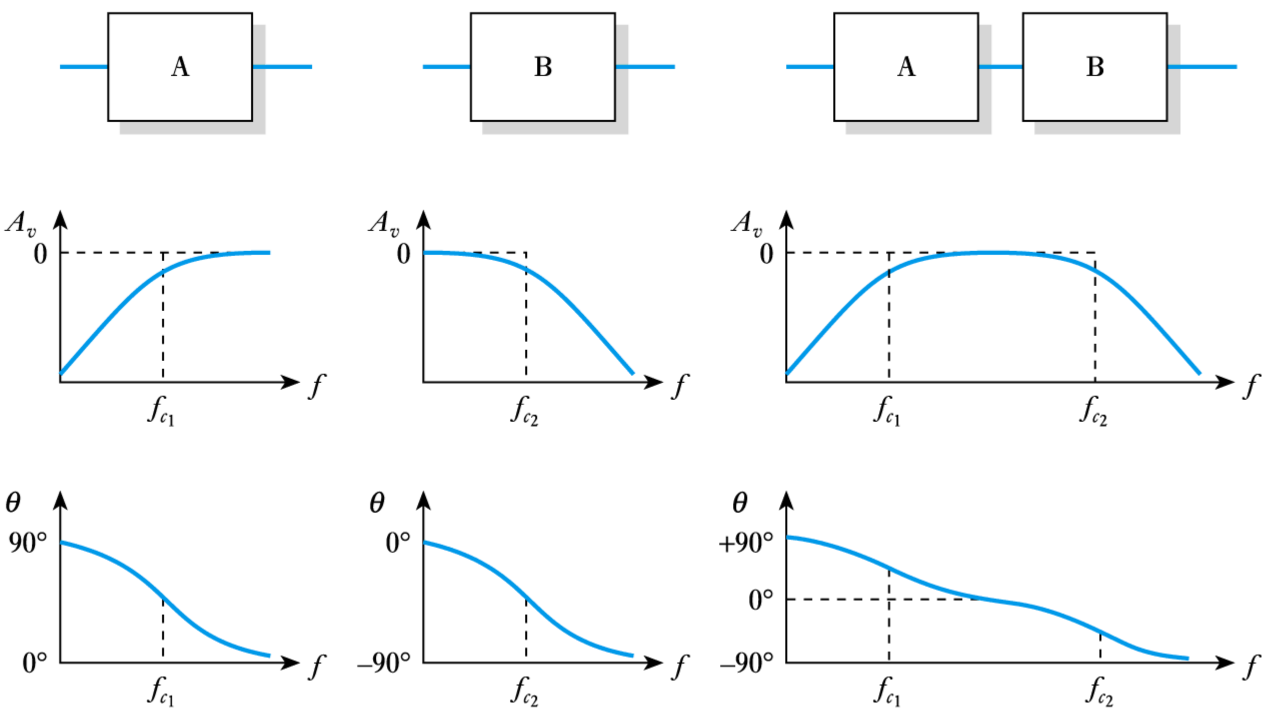
- Creating more detailed Bode diagrams



(a) High-pass circuit (b) Low-pass circuit

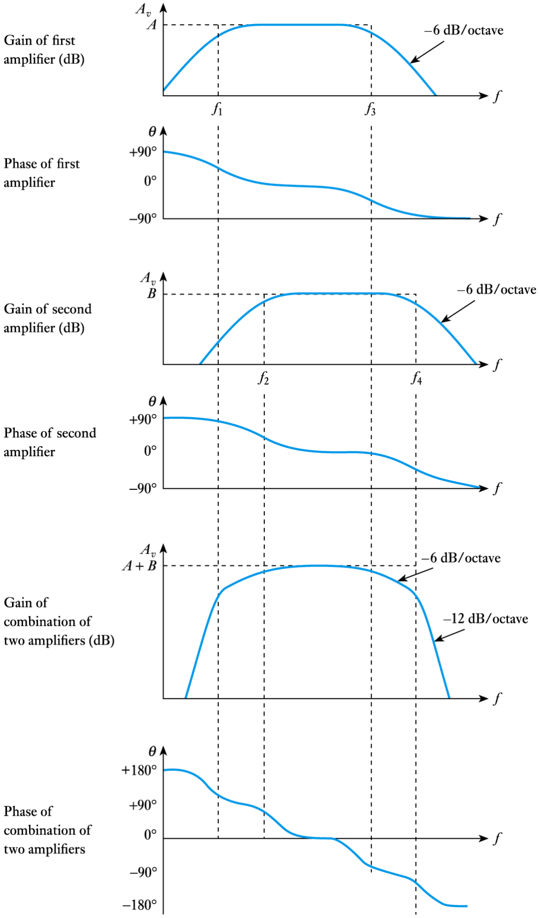
Combining the Effects of Several Stages

- The effects of several stages ‘add’ in bode diag



(a) High-pass circuit (b) Low-pass circuit (c) Band-pass circuit

- Multiple high- and low-pass elements may also be combined
  – this is illustrated in **Figure 17.14** in the course text



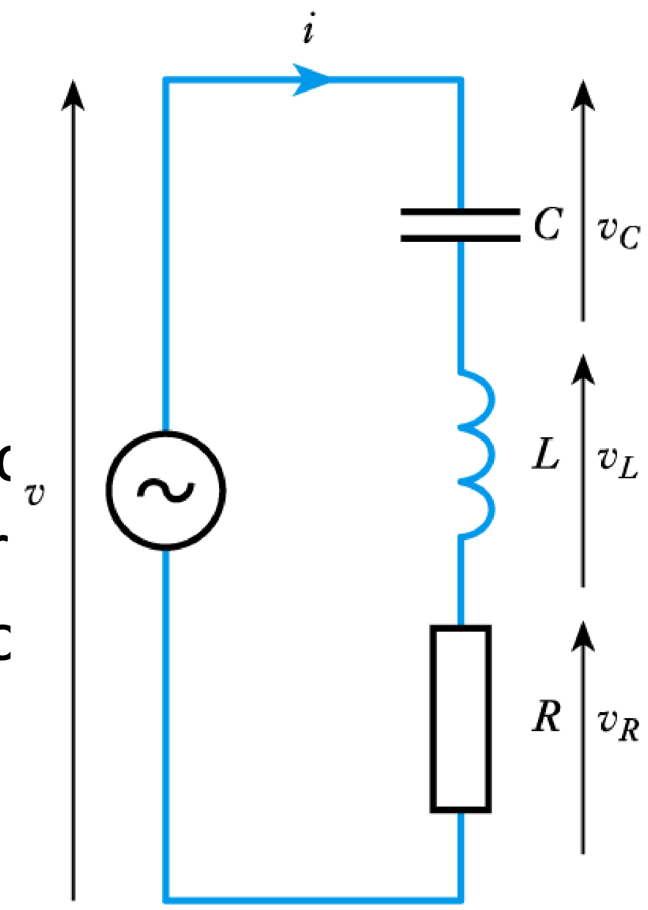
RLC Circuits and Resonance

- **Series *RLC* circuits**
  - the impedance is given by

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

  - if the magnitude of the reactanc of the inductor and capacitor ar equal, the imaginary part is zerc and **the impedance is simply *R***
  - this occurs when

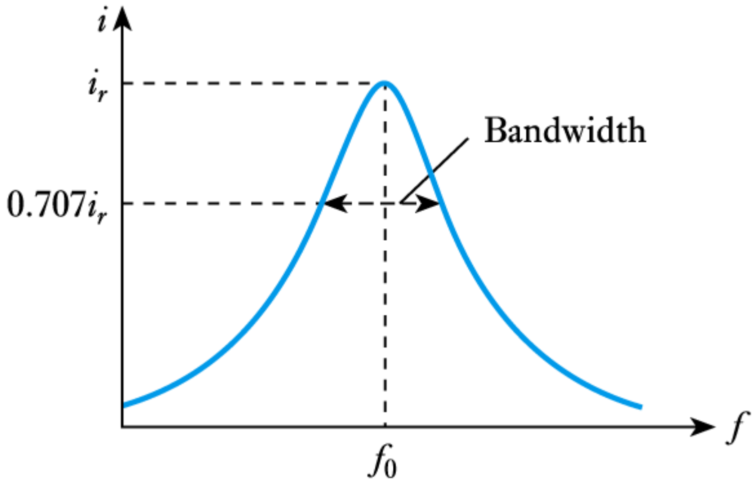
$$\omega L = \frac{1}{\omega C} \qquad \omega^2 = \frac{1}{LC} \qquad \omega = \frac{1}{\sqrt{LC}}$$



- This situation is referred to as **resonance**
  - the frequency at which is occurs is the **resonant frequency**

$$\omega_o = \frac{1}{\sqrt{LC}} \qquad f_o = \frac{1}{2\pi\sqrt{LC}}$$

  - in the **series resonant circuit**, the *impedance* is at a minimum at resonance
  - the *current* is at a maximum at resonance



- The resonant effect can be quantified by the **quality factor, Q**
  - this is the ratio of the energy dissipated to the energy stored in each cycle
  - it can be sho

$$\text{Quality factor } Q = \frac{X_L}{R} = \frac{X_C}{R}$$

  - and

$$Q = \frac{1}{R}\sqrt{\left(\frac{L}{C}\right)}$$

THANKS….

Queries Please…