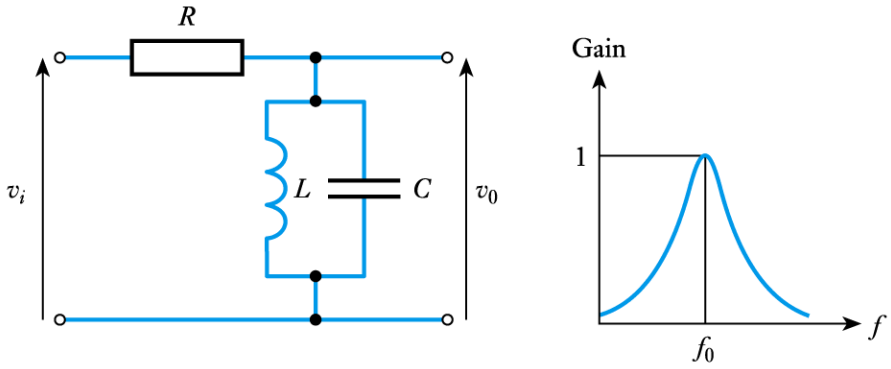
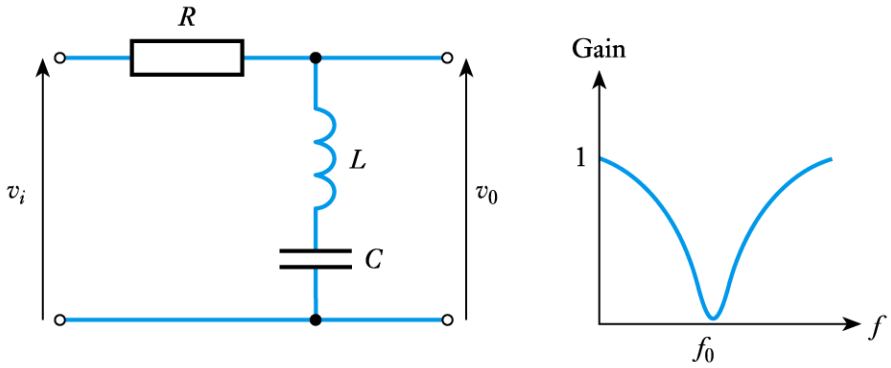
NETWORK ANALYSIS AND SYNTHESIS

- ***LC* Filters**
- Simple LC filters can be produced using series or parallel tuned circuits
  - these produce narrow-band filters with a centre freq

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

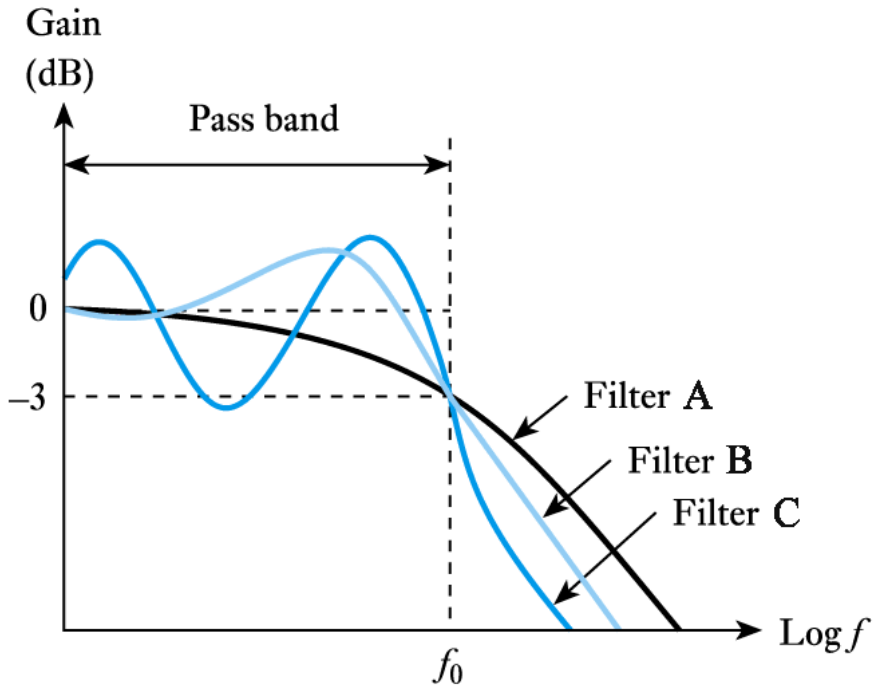


(a) A parallel *LC* network



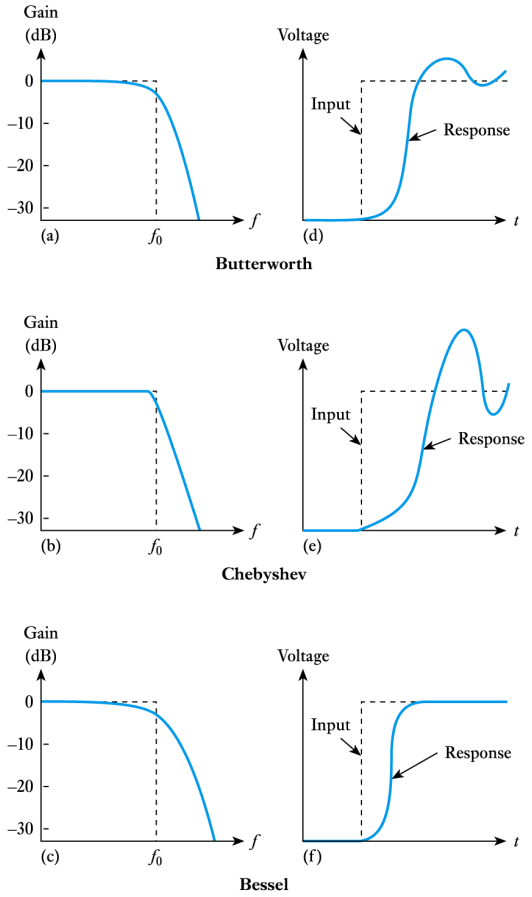
(b) A series *LC* network

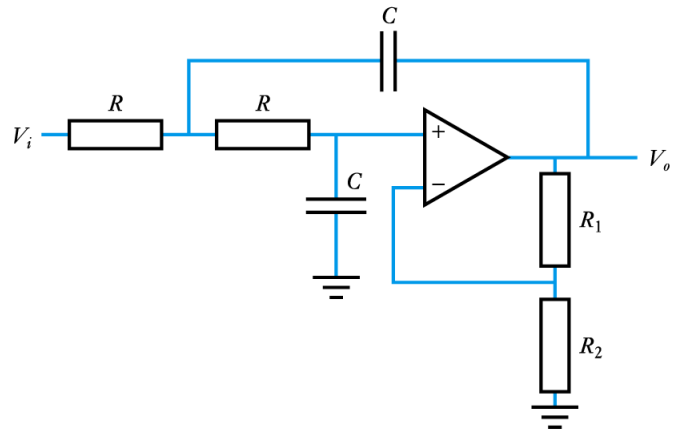
- **Active filters**
  - combining an op-amp with suitable resistors and capacitors can produce a range of filter characteristics
  - these are termed **active filters**



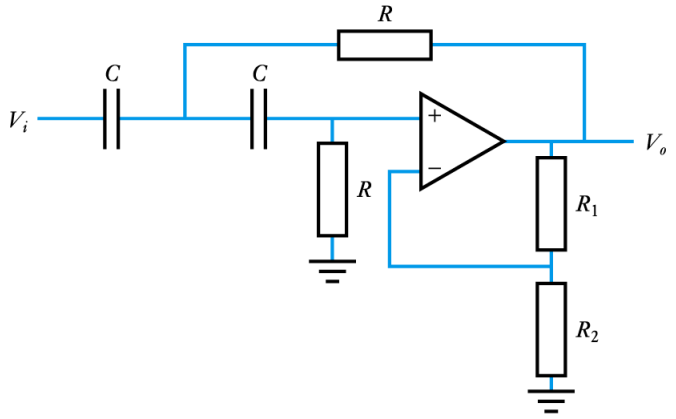
- Common forms include:
- **Butterworth**
  - optimised for a flat response
- **Chebyshev**
  - optimised for a sharp ‘knee’
- **Bessel**
  - optimised for its phase response

see **Section 17.10.3** of the course text for more information on these

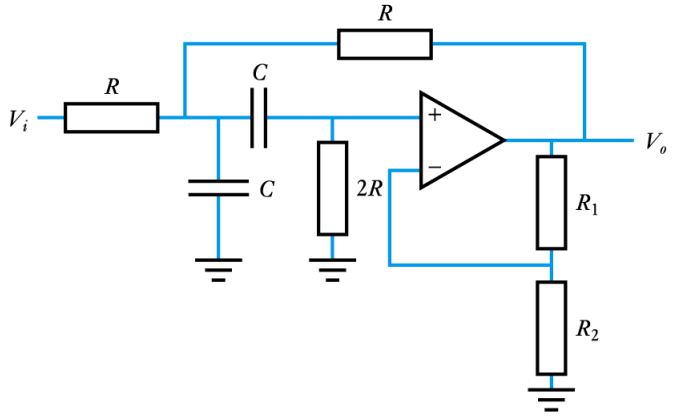




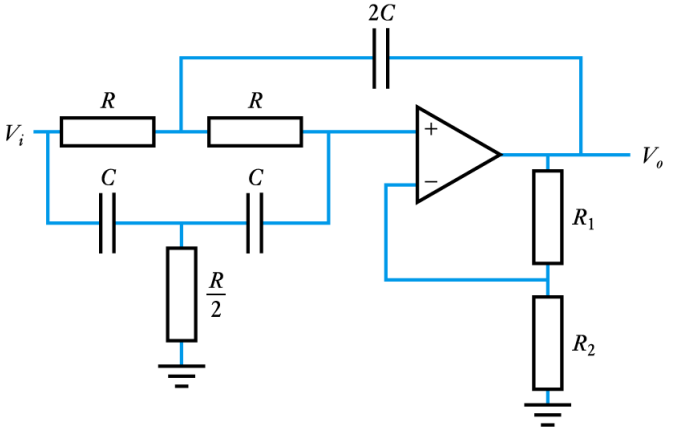
(a) A low-pass filter



(b) A high-pass filter



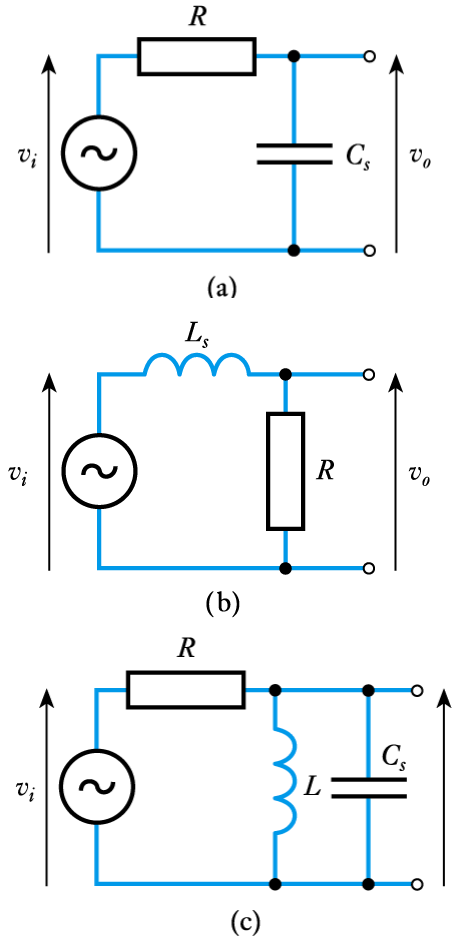
(c) A band-pass filter



(d) A band-stop filter

Stray Capacitance and Inductance

- All circuits have stray capacitance and stray inductance
  - these unintended elements can dramatically affect circuit operation
  - for example:
    - (a) C_s adds an unintended low-pass filter
    - (b) L_s adds an unintended low-pass filter
    - (c) C_s produces an unintended resonant circuit and can produce instability



Key Points

- The reactance of capacitors and inductors is dependent on frequency
- Single *RC* or *RL* networks can produce an arrangement with a single upper or lower cut-off frequency.
- In each case the angular cut-off frequency ω_o is given by the reciprocal of the time constant T
- For an *RC* circuit $\mathrm{T} = CR$, for an *RL* circuit $\mathrm{T} = L/R$
- Resonance occurs when the reactance of the capacitive element cancels that of the inductive element
- Simple *RC* or *RL* networks represent single-pole filters
- Active filters produce high performance without inductors
- Stray capacitance and inductance are found in all circuits

THANKS….

Queries Please…