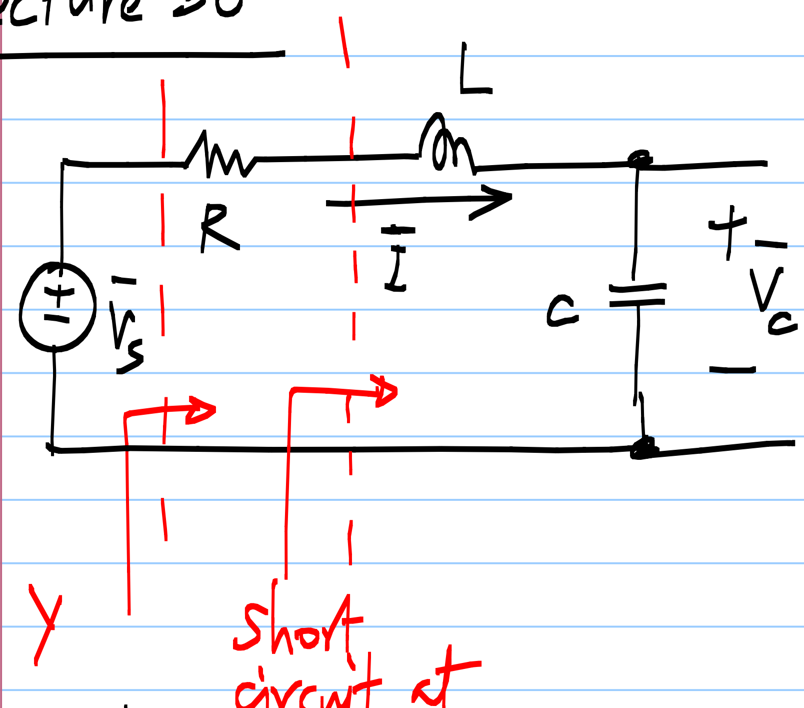
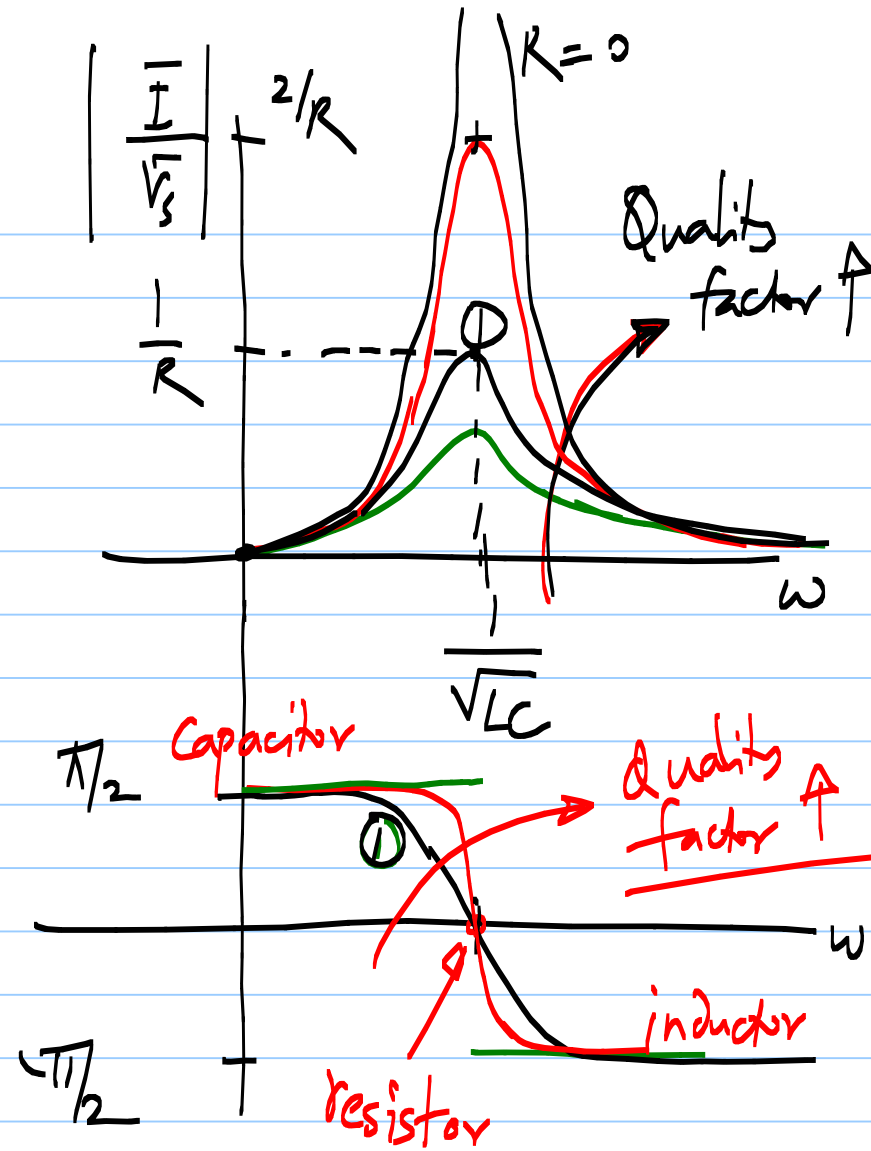
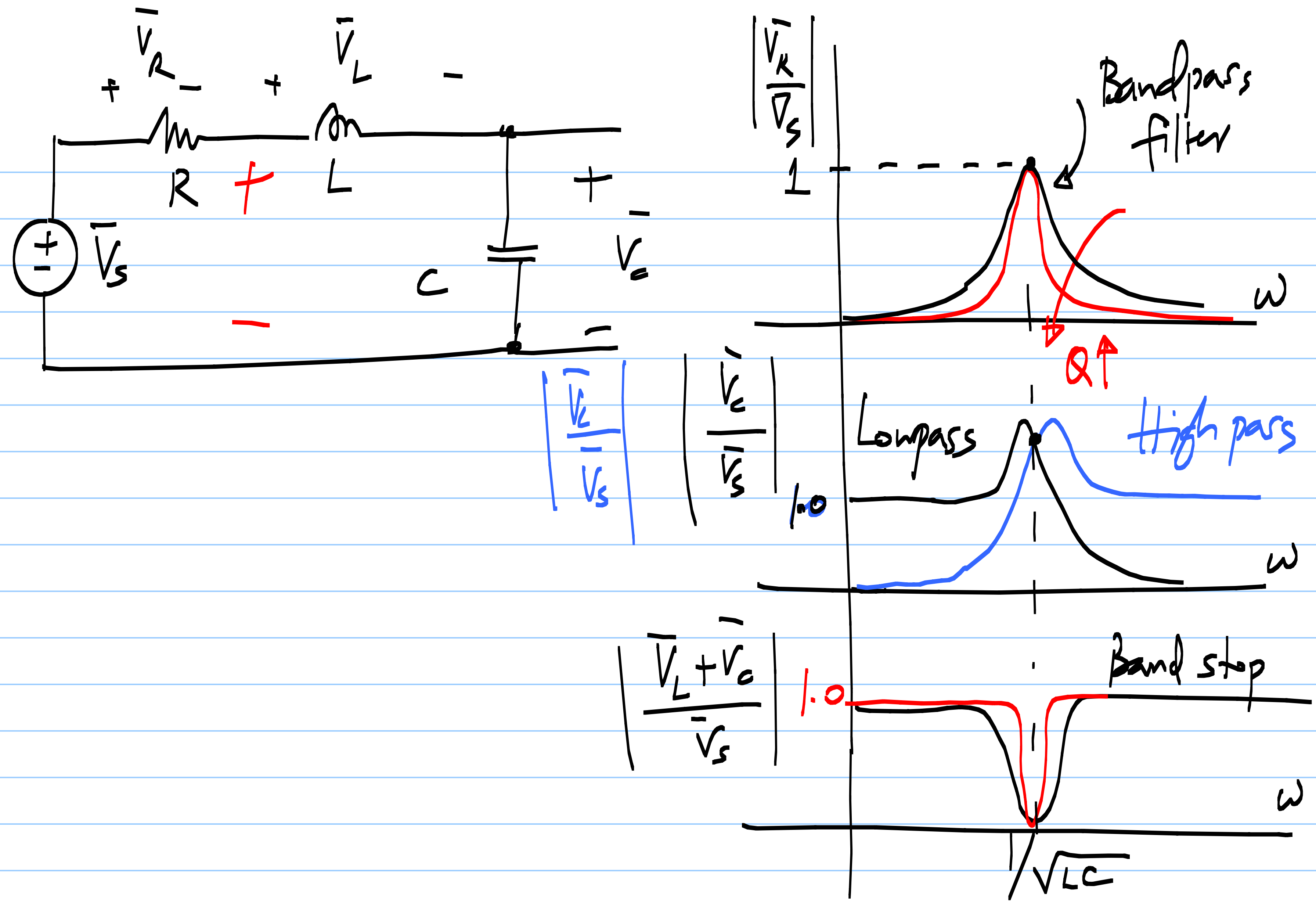
Lecture 30



$j\omega L + \frac{1}{j\omega C}$ $\frac{1}{\sqrt{LC}}$, resonance frequency





$\bar{V}_R$
R
$\bar{V}_L$
L
C
$\bar{V}_s$
$\bar{V}_c$
$\left|\frac{\bar{V}_R}{\bar{V}_s}\right|$
1
Bandpass filter
Q↑
ω
$\left|\frac{\bar{V}_L}{\bar{V}_s}\right|$
$\left|\frac{\bar{V}_c}{\bar{V}_s}\right|$
1.0
Lowpass
High pass
ω
$\left|\frac{\bar{V}_L+\bar{V}_c}{\bar{V}_s}\right|$
1.0
Band stop
ω
$1/\sqrt{LC}$

Nodal analysis:

$$[G] \cdot \underline{v} = \underline{I}$$

@ a particular freq. ω

$$[Y] \bar{\underline{v}} = \bar{\underline{I}}$$

- $[Y]$: Admittance matrix
- $\bar{\underline{v}}$: variable vector
  - Node voltage (phasors)
  - Aux. variables (phasors)
- $\bar{\underline{I}}$: Ind. source vector (phasor)

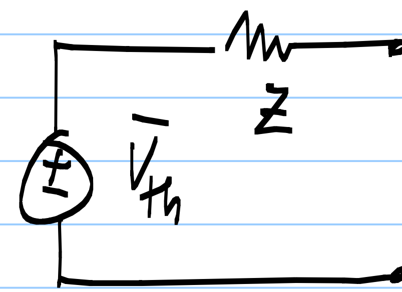
Mesh analysis:

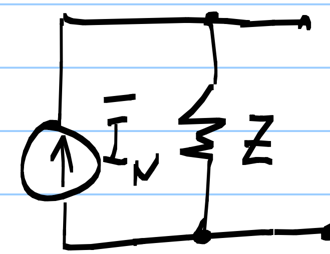
$$[R] \cdot \underline{i} = \underline{V}$$

$$[Z] \cdot \bar{\underline{I}} = \bar{\underline{V}}$$

Substitution theorem: replace z with $\bar{V}_z$ or $\bar{I}_z$

Thevenin / Norton :





Tellegen's theorem : KVL/KCL ✓

Reciprocity theorem : works in the phasor domain

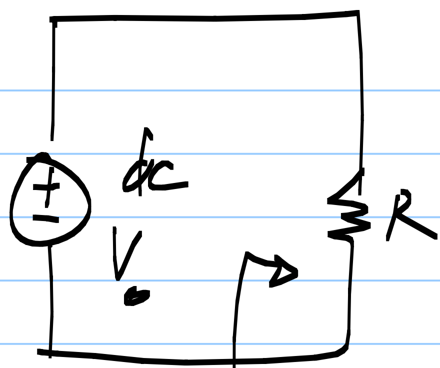
R, L, C

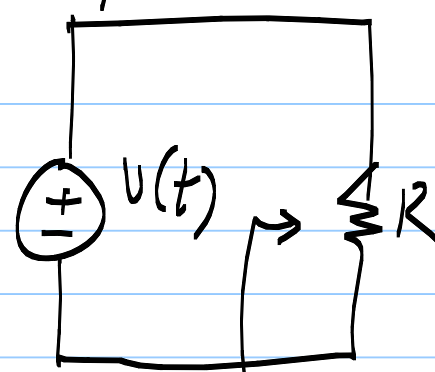
Compensation theorem : ✓

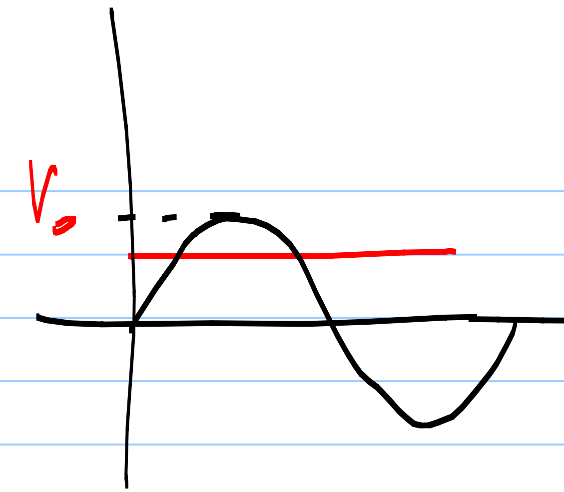
Two port parameters: $\underline{\bar{I}} = [Y] \underline{\bar{V}}$

Complex parameters.

$v(t) = V_p \cos \omega t$







Power: $\frac{V_0^2}{R}$

Instantaneous power: $\frac{v(t)^2}{R}$

$$\frac{V_p^2 \cos^2 \omega t}{R} = \frac{V_p^2}{2R}(1 + \cos 2\omega t)$$

average $V_p^2/2R$

Equal average power:

$$\frac{V_0^2}{R} = \frac{V_p^2}{2R}$$

$$\frac{V_p}{\sqrt{2}} = V_0$$

peak/amplitude

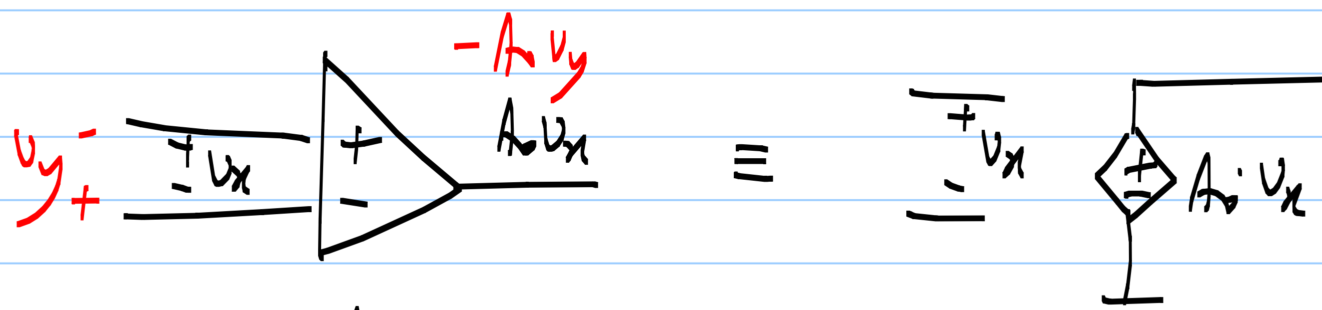
$\frac{V_p}{\sqrt{2}}$: rms value of the sinusoid. $V_p \cos \omega t$

rms → root mean squared

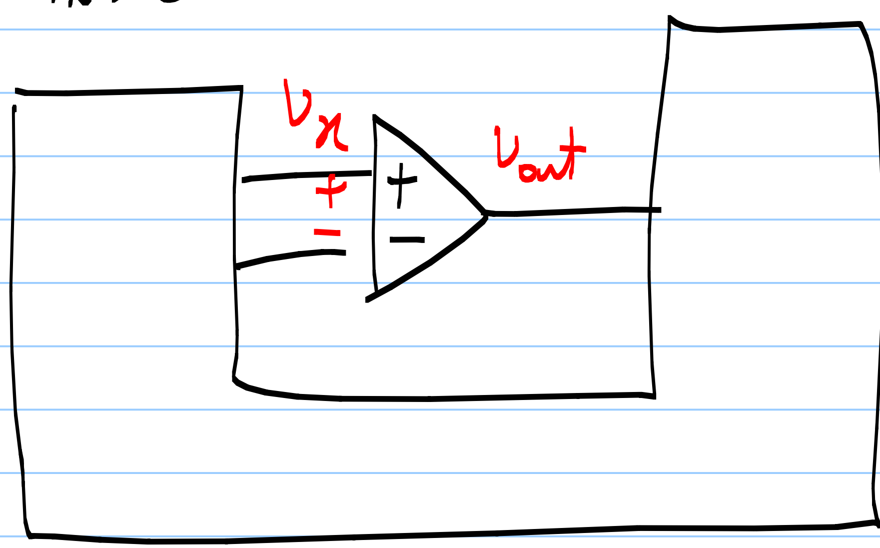
$v(t)$: period T mean squared value : $\frac{1}{T}\int_0^T v^2(t)\,dt$

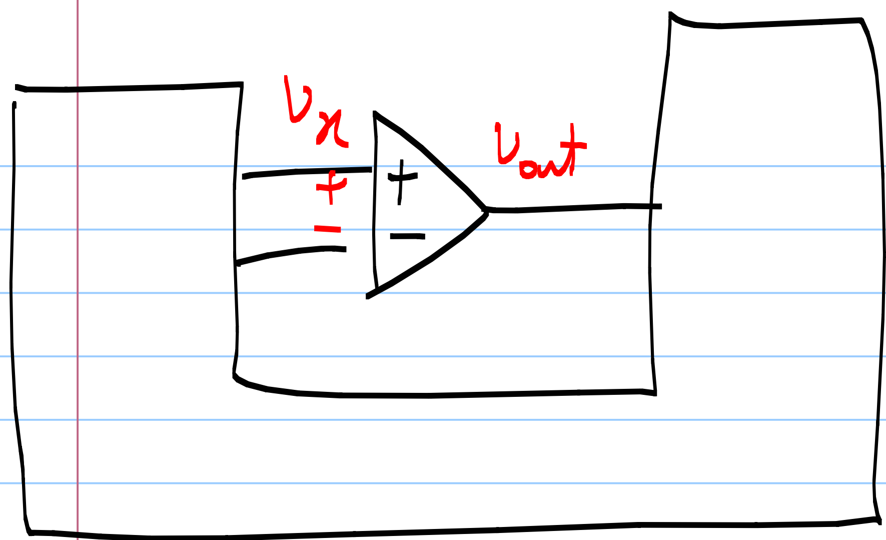
rms : $\sqrt{\frac{1}{T}\int_0^T v^2(t)\,dt}$

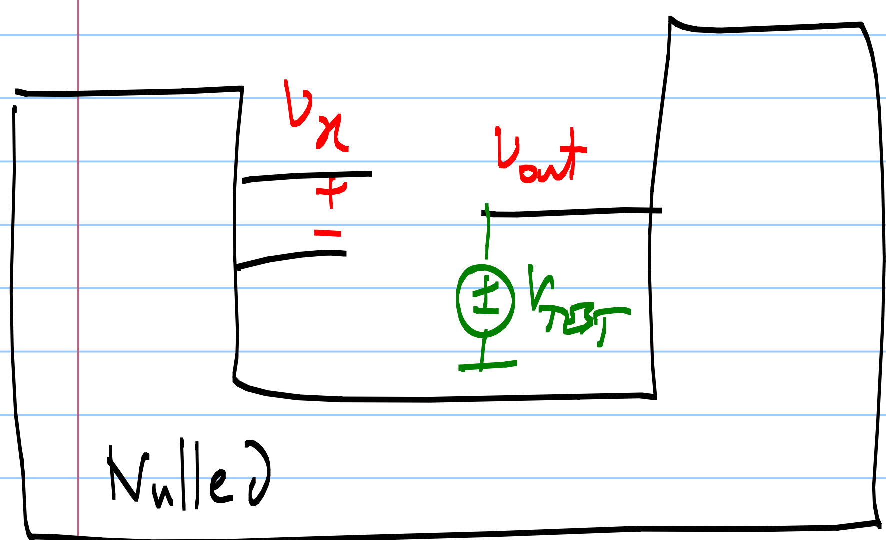
opamp:



$A_0 > 0$







- Assume the signs
- Identify v_x & v_{out}
- Remove the opamp & apply V_{TEST} at the o/p
- Calculate v_x $\left(= (\ ) \cdot V_{TEST}\right)$

−ve fb if this number is negative