Lecture # 01 — Analog Circuits

Note Title 04-08-2021

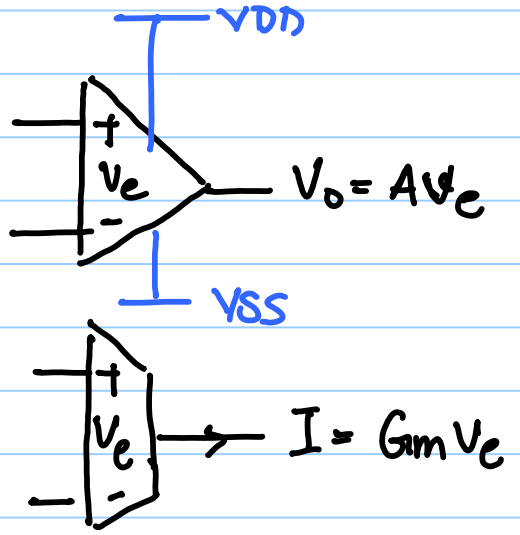
EE2019 : Analog Systems.

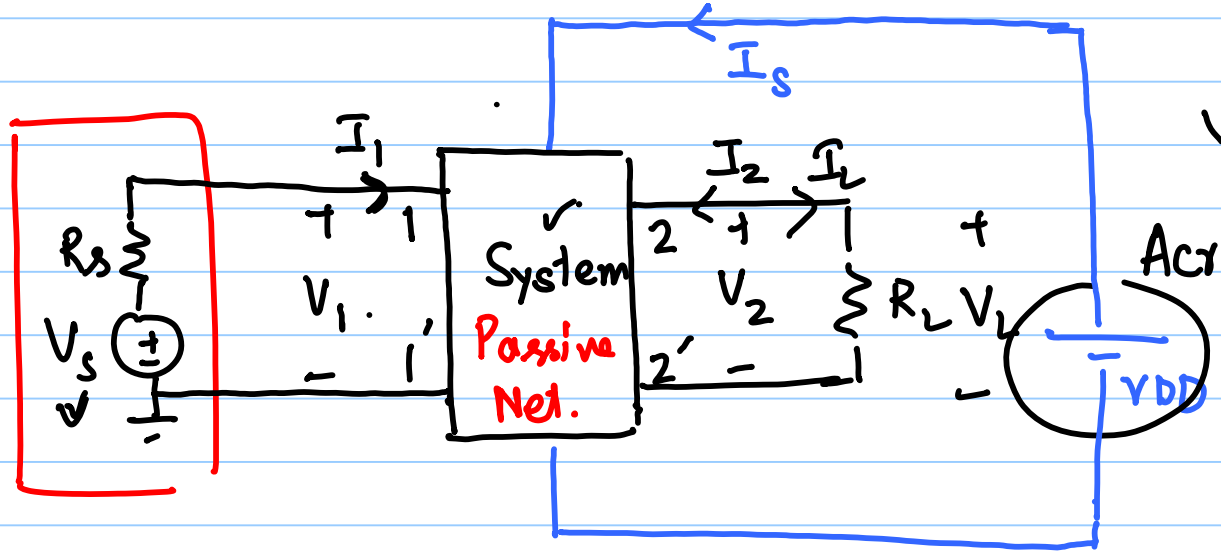
1. Opamp : voltage gain + power gain

   Voltage buffers, filters, oscillators,

2. Transconductance Gm :

3. Linear elements R, L, C





$V_1 I_1 + V_2 I_2 \geq 0$

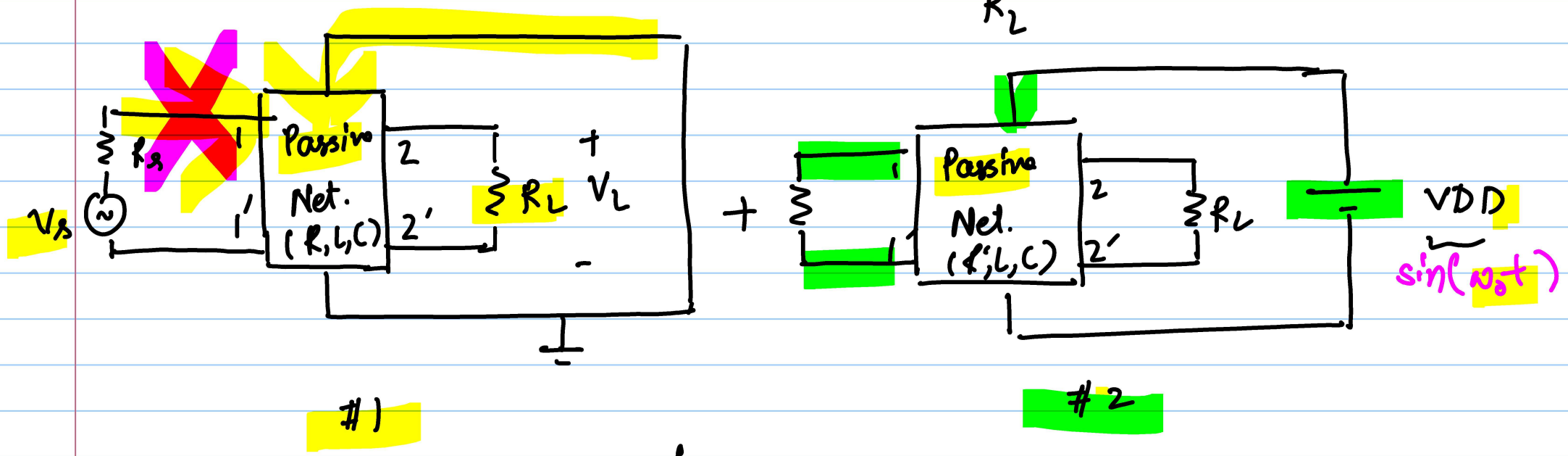
Across load R_L.

$P_L = -I_2 V_2 = -I_2 V_L$

$V_1 I_1 + V_{DD} \times I_s + V_2 I_2 \geq 0$

$-V_2 I_2 > V_1 I_1$ ✓

If $V_s = a \sin(\omega_0 t)$ ✓ $\longrightarrow$ $P_L = \frac{V_L^2}{R_L}$



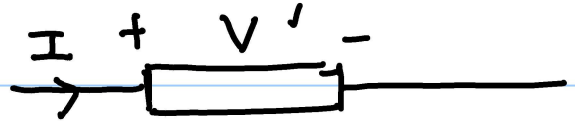
Passive and non-linear

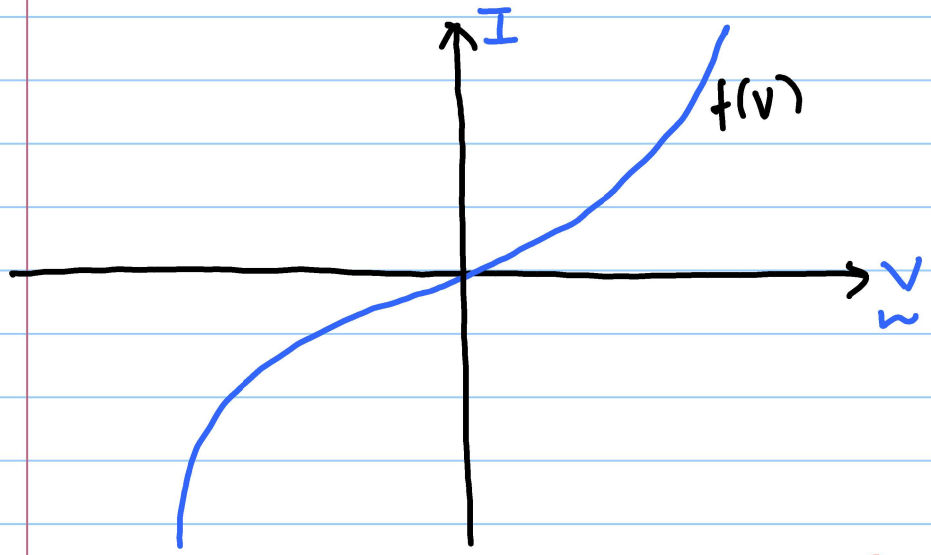
Passive and linear

#1: Non-linear elements to deliver power to the load R_L.

#2: Active elements

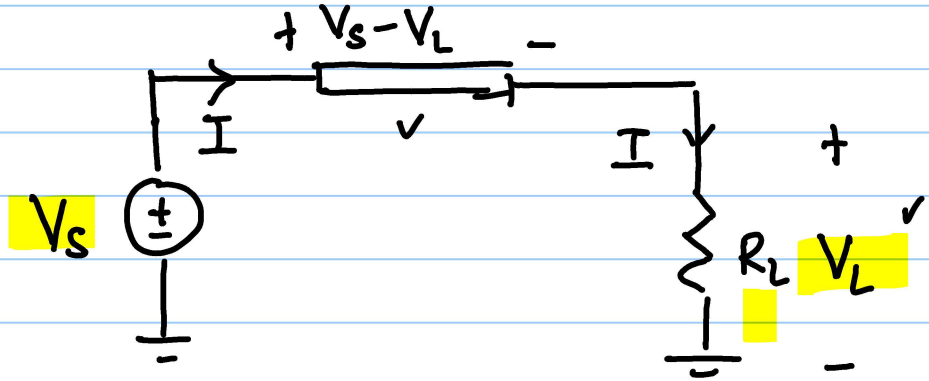
$V_L I_L$: Power delivered to the load ✓





$I = f(V)$ Non-linear

$V \cdot I \geq 0$

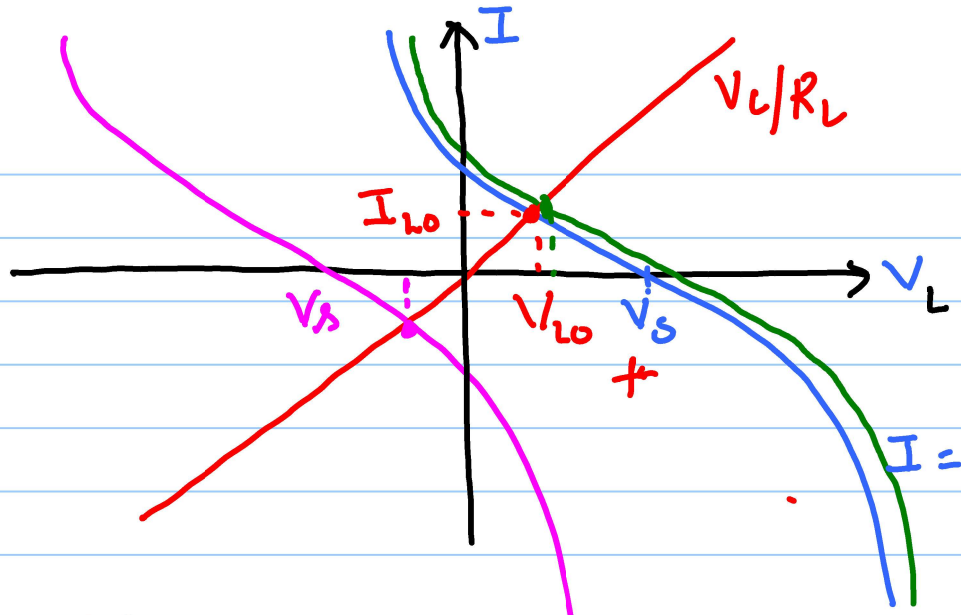


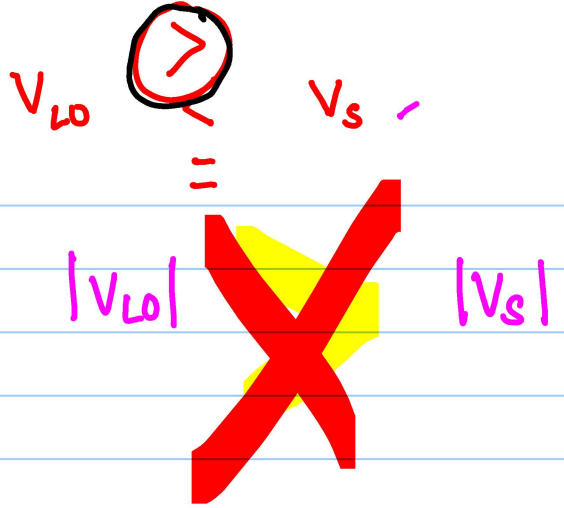
V_{L0}, I_{S0}

$$\begin{cases} I = f(V) = f(V_s - V_L) & -(1) \\ I = \dfrac{V_L}{R_L} & -(2) \end{cases}$$

Ex: $f(V) = a_1 V + a_3 V^3 + a_5 V^5 + \dots$

$I = a_1 (V_s - V_L) + a_3 (V_s - V_L)^3 + \dots = \dfrac{V_L}{R_L}$





$f(V) \rightarrow f(V_S - V_L)$

$f(v_l) \rightarrow f(-v_l) \rightarrow f(-(V_l - V_S)) = f(V_S - V_L)$

$V_S = V_{SO} \longrightarrow V_{SO} + v_s$ ✓

What happens to V_L.