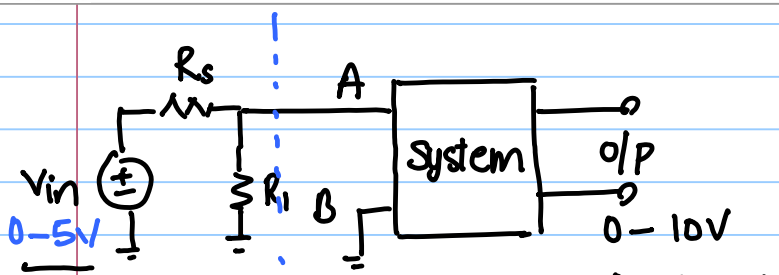
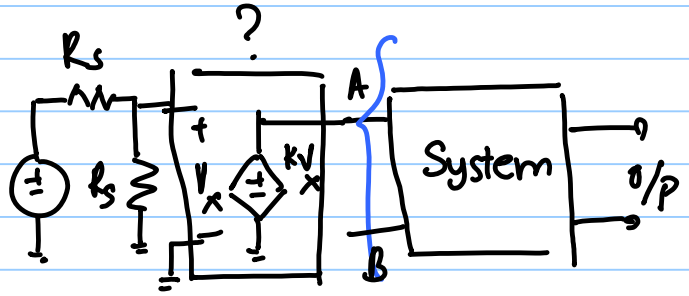
Note Title 21-01-2020

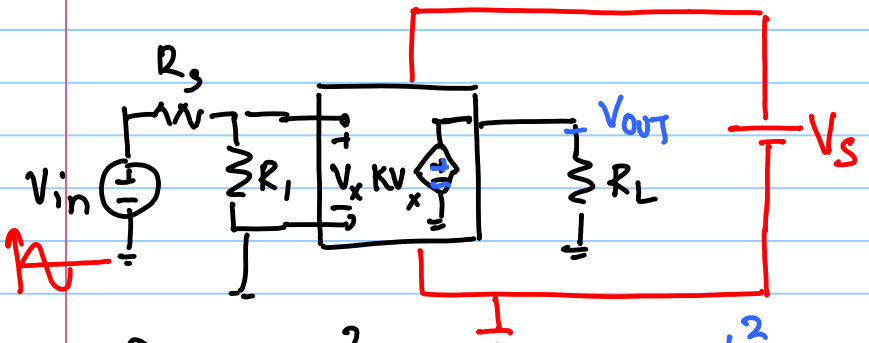
# Lecture #3




$$V_{AB} = \frac{R_1}{R_1+R_s} V_{in}$$




VCVS, CCVS,




$$P_{in} = \frac{V_{in}^2}{R_s+R_1}, \quad P_{OUT} = \frac{V_{OUT}^2}{R_L}$$

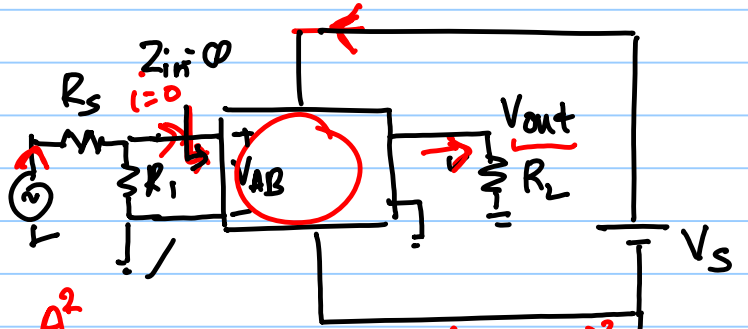
$P_{OUT} > P_{IN}$

$P_{OUT} \leq P_S + P_{IN}$

$V_{in} = A\sin(\omega t)$, $V_S = 12V$

$V_{OUT} = aV_{in} + bV_s$

$P_{OUT} > P_{IN}$



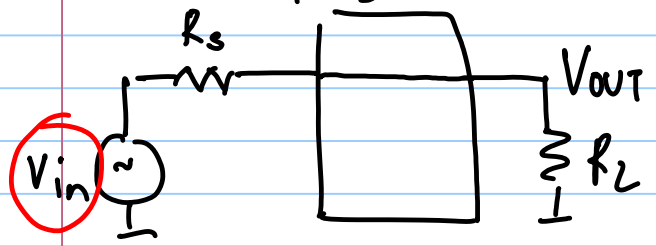

$$P_{in} = \frac{A^2}{(R_s+R_1)}, \quad P_{OUT} = \frac{(2abV_s)^2}{2R_L}$$

$V_S = 0$, $V_{in} = A\sin(\omega_0 t)$

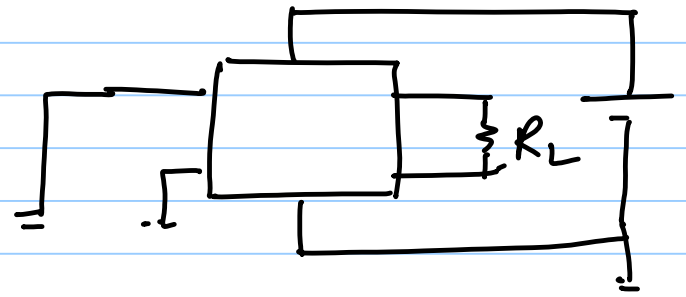
$V_{OUT} = a V_{in}$

$= aA\sin(\omega_0 t)$

$P_{IN} = \frac{A^2}{2(R_1 + R_S)}$, $P_{OUT} =$




$V_S = 12V$, $V_{in} = 0$




$V_{OUT} = b V_S$

---

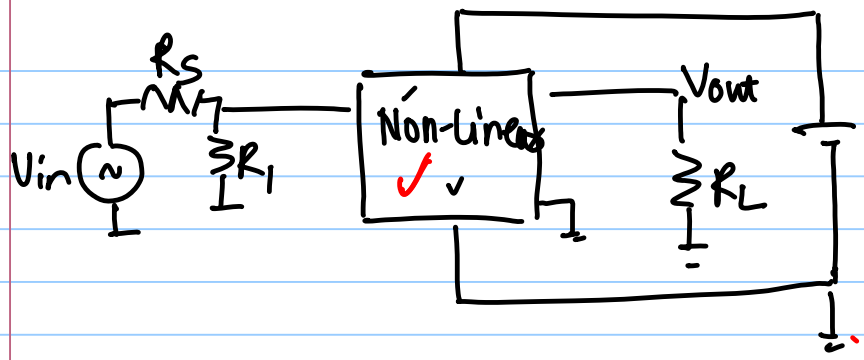
$V_{OUT} = (a V_{in} + b V_S)^2$ ✓

$= (a \cdot A\sin(\omega_0 t) + b \cdot V_S)^2$

$= a^2 A^2 \sin^2(\omega_0 t) + b^2 V_S^2 + 2abA V_S \sin(\omega_0 t)$

$= \left(\frac{a^2 A^2}{2} + b^2 V_S^2\right) + (2abV_S) A\sin(\omega_0 t) + \frac{a^2 A^2}{2}\cos(2\omega_0 t)$ ✓

$= d_0 + \alpha_1 (V_{in}) + \alpha_2 \cos(2\omega_0 t)$

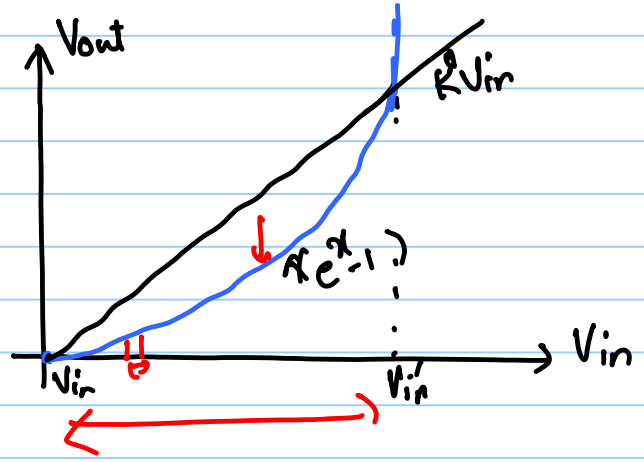


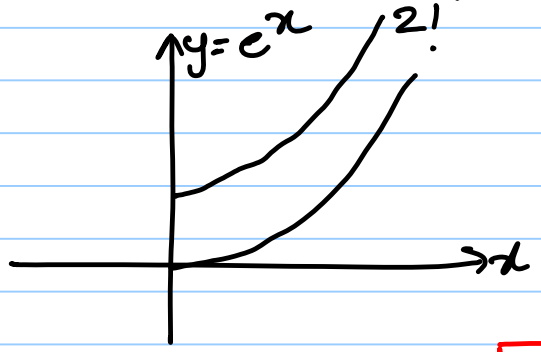

Linear Voltage / Current Relationship.

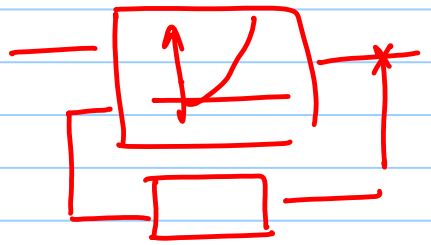
fourier / laplace → Linear systems

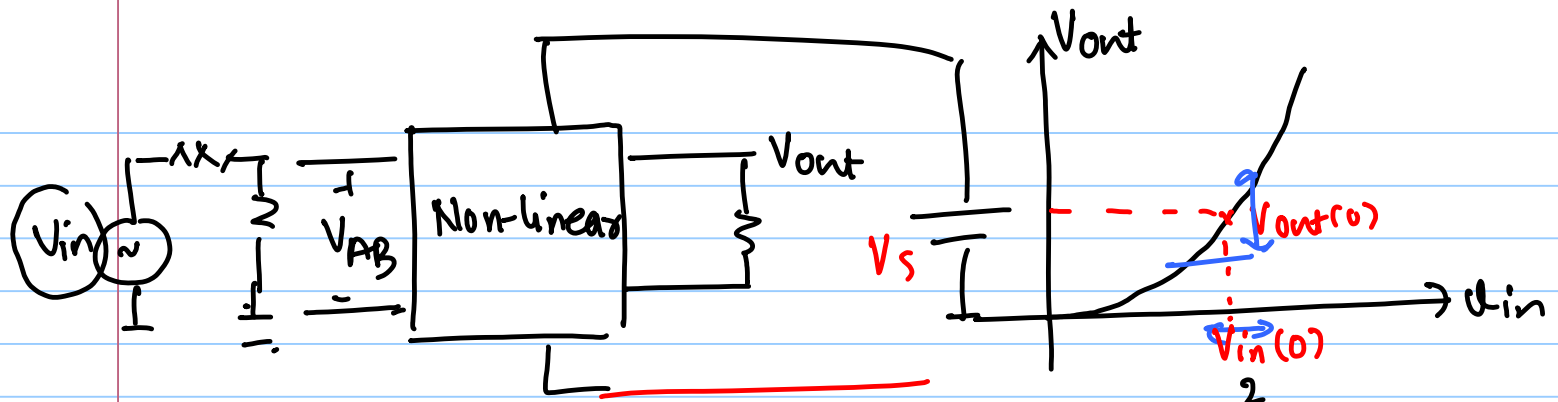
$$V_{out} = f(V_{in}) = \alpha_0 + \alpha_1 V_{in} + \alpha_2 V_{in}^2 + \dots$$

$$V_{out} = \exp(-\alpha V_{in}) = 1 - \alpha V_{in} + \frac{(\alpha V_{in})^2}{2!} + \dots$$






$V_{in} \longrightarrow V_{in} + \Delta V_{in}$

$V_{out} \longrightarrow V_{out} + \Delta V_{out}$

$\Delta V_{out} \approx K \Delta V_{in}$

$V_{out} = \alpha V_{in}^2$

$V_{in} = V_{in}(0), \quad V_{out} = \alpha V_{in}^2(0)$

$V_{in} \longrightarrow V_{in}(0) + \Delta V_{in}$

$V_{out} = \alpha \left( V_{in}(0) + \Delta V_{in} \right)^2$

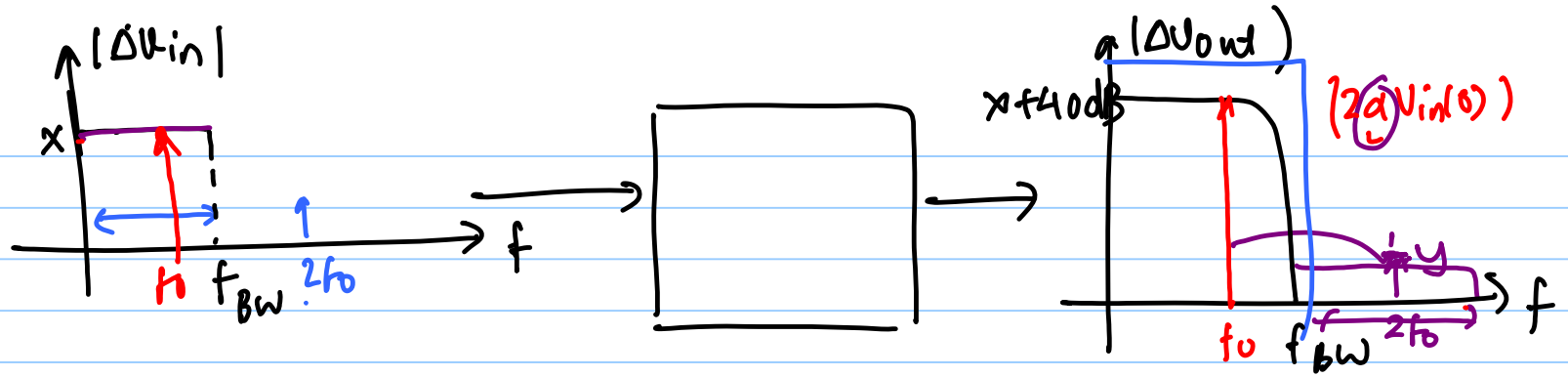
$= \alpha V_{in}^2(0) + (\Delta V_{in})^2 + 2\alpha V_{in}(0) \Delta V_{in}$

$= V_{out}(0) + 2\alpha V_{in}(0) \cdot \Delta V_{in} + \alpha (\Delta V_{in})^2$

$\Delta V_{out} = 2\alpha V_{in}(0) \cdot \Delta V_{in} + \alpha (\Delta V_{in})^2 \approx (2\alpha V_{in}(0)) \Delta V_{in}$

in . $\Delta V_{in} \ll V_{in}(0)$

$\Delta V_{out} \approx K (\Delta V_{in})$




$y \ll (x + 40\,dB)$

$\Delta v_{in} = a\sin(\omega_0 t) + b\sin(2\omega_0 t)$