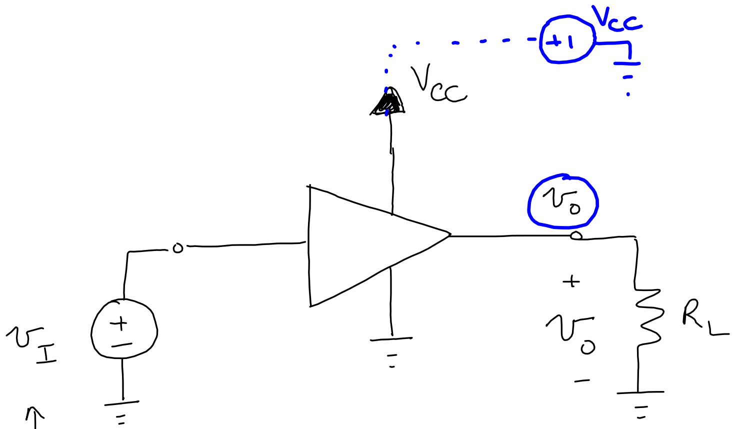
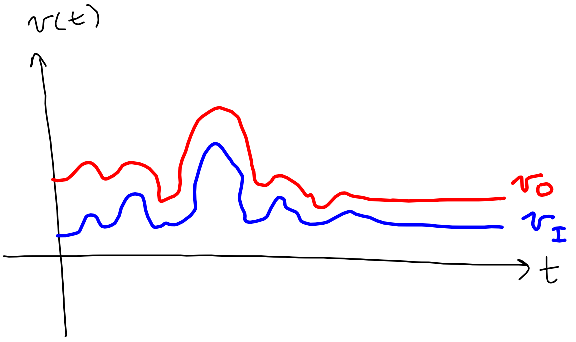
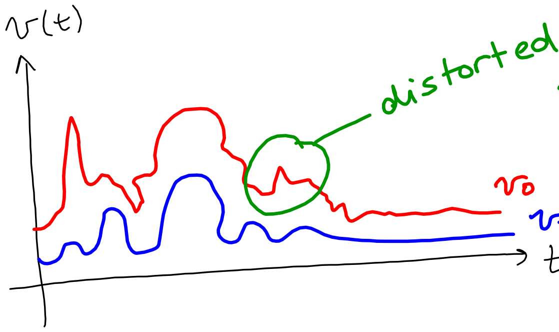



$v_I$ is a weak or small signal (mV to µV)

$v_O$ is the amplified version of $v_I$ (.1 V to 1 V)

Good amplification => Linear $\quad v_O = \underset{\substack{\uparrow \\ \text{constant}}}{A}\, v_I$

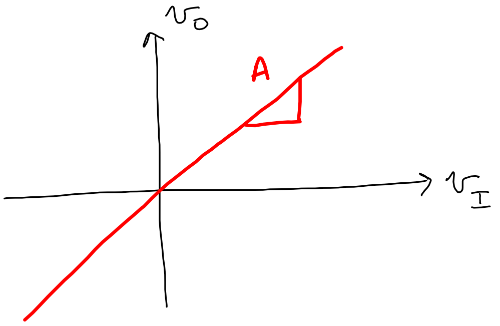


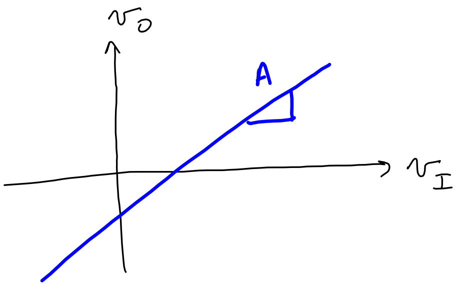

$v_O = A v_I$

$v_O = A v_I + \underbrace{A v_i^2 + A v_i^3 \ldots}_{\text{get rid}}$

voltage transfer characteristic: (VTC)




$v_O = A v_I$




$v_O = A v_I + b$

Amplifier design goals => linear amplification
no distortion

## Amplifier Types

voltage amps => $v_O = A_v \cdot v_I$ $A_v \equiv$ voltage gain

current amps => $i_O = A_i \cdot i_I$ $A_i \equiv$ current gain

power amps => $p_O = A_p \cdot p_I$ $A_p \equiv$ power gain

$$A_v = \frac{v_O}{v_I}\left(\frac{V}{V}\right) \qquad A_i = \frac{i_O}{i_I}\left(\frac{A}{A}\right) \qquad A_p = \frac{p_O}{p_I}\left(\frac{W}{W}\right)$$

$$= \frac{v_O\, i_O}{v_I\, i_I} = \left(\frac{VA}{VA}\right)$$

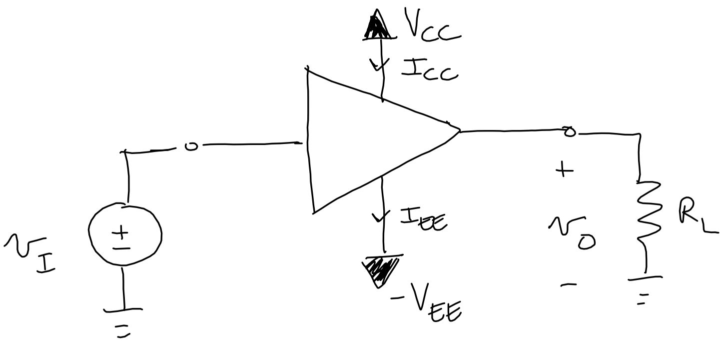
if using log scale => express gain in dB.

dB

$A_v = 20 \log |A_v|$ $\qquad A_v = -10\ V/V$

$A_i = 20 \log |A_i|$

$A_p = 10 \log |A_p|$



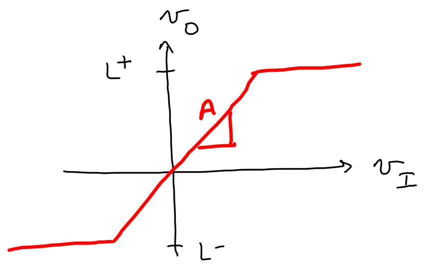

dissipated in amp

$$\underbrace{P_{dc}}_{\text{larger}} + \underbrace{P_I}_{\text{small}} = P_L + P_{LOSS}$$

amplifier efficiency: $\eta = \frac{P_L}{P_{dc}} \times 100$ => percent efficiency

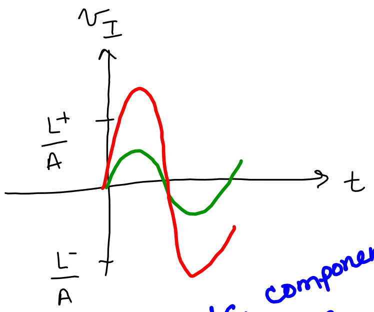
## Amplifier saturation

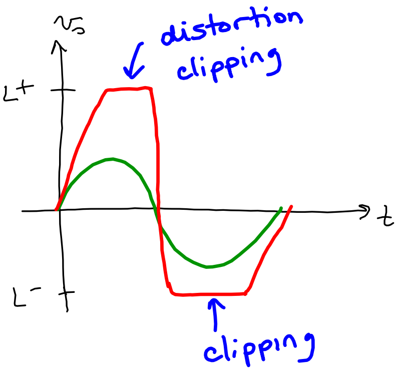
$$v_O = A\, v_I$$




$$\frac{L^-}{A} \le v_I \le \frac{L^+}{A}$$

$L^+$, $L^-$ are typically 90-99% of the dc supply




dc component

DC bias

$$v_O = V_O + v_o(t)$$

$$i_A = I_A + i_a(t)$$

total signal

AC component

small-signal component

large signal resistance $R_i$, $R_o$, $R_I$, $R_O$

small signal resistance $r_\pi$, $r_o$, $r_i$