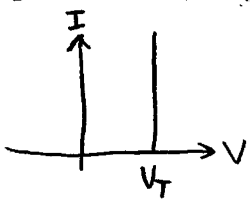
Inbyggd elektronik 2018-04-13 #7

RE Active Components (OP-AMP Diode)

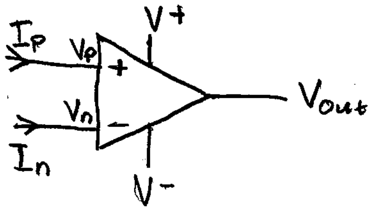
Diode



Ideal voltage source (V_T) in forward direction
$V_D < V_T$ the diode blocks current ie $I_D = 0A$.

A resistor in series with the diode limits the current!

IDEAL OP-AMP



If the op-amp operates in the linear region then $\boxed{V_n = V_p}$ (Ch 5.2 in book)

Using negative feedback we can make the op-amp operate in the linear region.

The input resistance of an ideal op-amp is ∞

$$\Rightarrow \boxed{I_n = I_p = 0A}$$

There is many resistive net configurations to create different circuit functions.

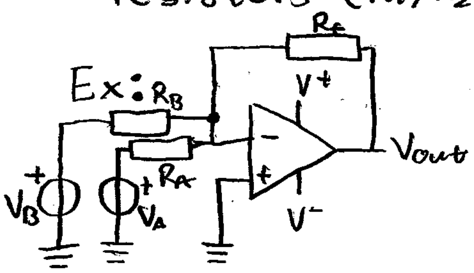
The book describes 4 of them: Inverting amplifier
Summing amplifier
Non-inverting amplifier
Difference amplifier

Examples 5.1 - 5.5

Skills you should aquire

① Assuming ideal OP-AMP and assume operation in linear region derive an expression for V_{out} as a function of all input $V_{in}(V_A, V_B, V_C \ldots)$ and all resistors $(R_1, R_2 \ldots)$.

Ex:



$$\frac{V_B - 0}{R_B} + \frac{V_A - 0}{R_A} + \frac{V_{out} - 0}{R_f} = 0$$

$$\Rightarrow V_{out} = -\left(\frac{R_f}{R_A} \cdot V_A + \frac{R_f}{R_B} V_B\right)$$

The function is to scale and sum V_A and V_B to produce V_{out}

② Evaluate which inputs voltages are allowed to operate in the linear region, i.e. at what input voltages does V_{out} go to saturation V^+ or V^-

Ex again $V^+ = 16V$, $V^- = -16V$, $R_f = 4k\Omega$, $R_A = 2k\Omega$, $R_B = 1k\Omega$, $V_A > 0V$, $V_B > 0V$

$V_{out} = -(2V_A + 4V_B)$ at saturation $V_{out} = -16V \Rightarrow -16 = -2V_A - 4V_B$

$\Rightarrow V_B = -\frac{1}{2} V_A + 4$