Dr Satvir Singh

LINEAR INTEGRATED CIRCUITS

3-06

Log and Anti-log Amplifier

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Logarithmic Amplifier

In the shown circuit, current flowing through R can be written as,

$$i_R = \frac{v_{in}}{R} \qquad (1)$$

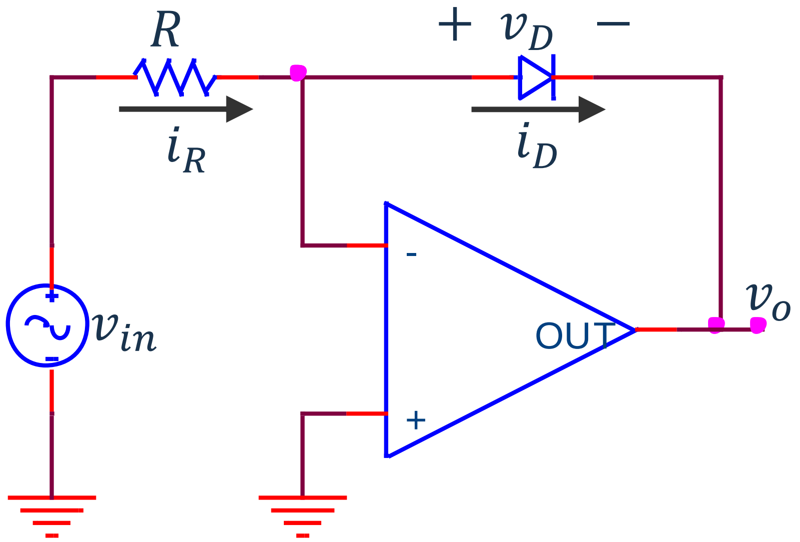
The voltage across diode is v_o and current that flows through diode is given by diode equation.

$$i_D = I_S(e^{\frac{v_D}{\eta V_T}} - 1) \approx I_S e^{\frac{v_D}{\eta V_T}} \qquad (2)$$

Since $i_R = i_D$, therefore,

$$\frac{v_{in}}{R} = I_S e^{\frac{-v_o}{\eta V_T}}$$

$$v_o = -\eta V_T \ln \frac{v_{in}}{I_S R}$$



Note that v_o depends upon I_S that further temperature dependent parameter

Improved Logarithmic Amplifier

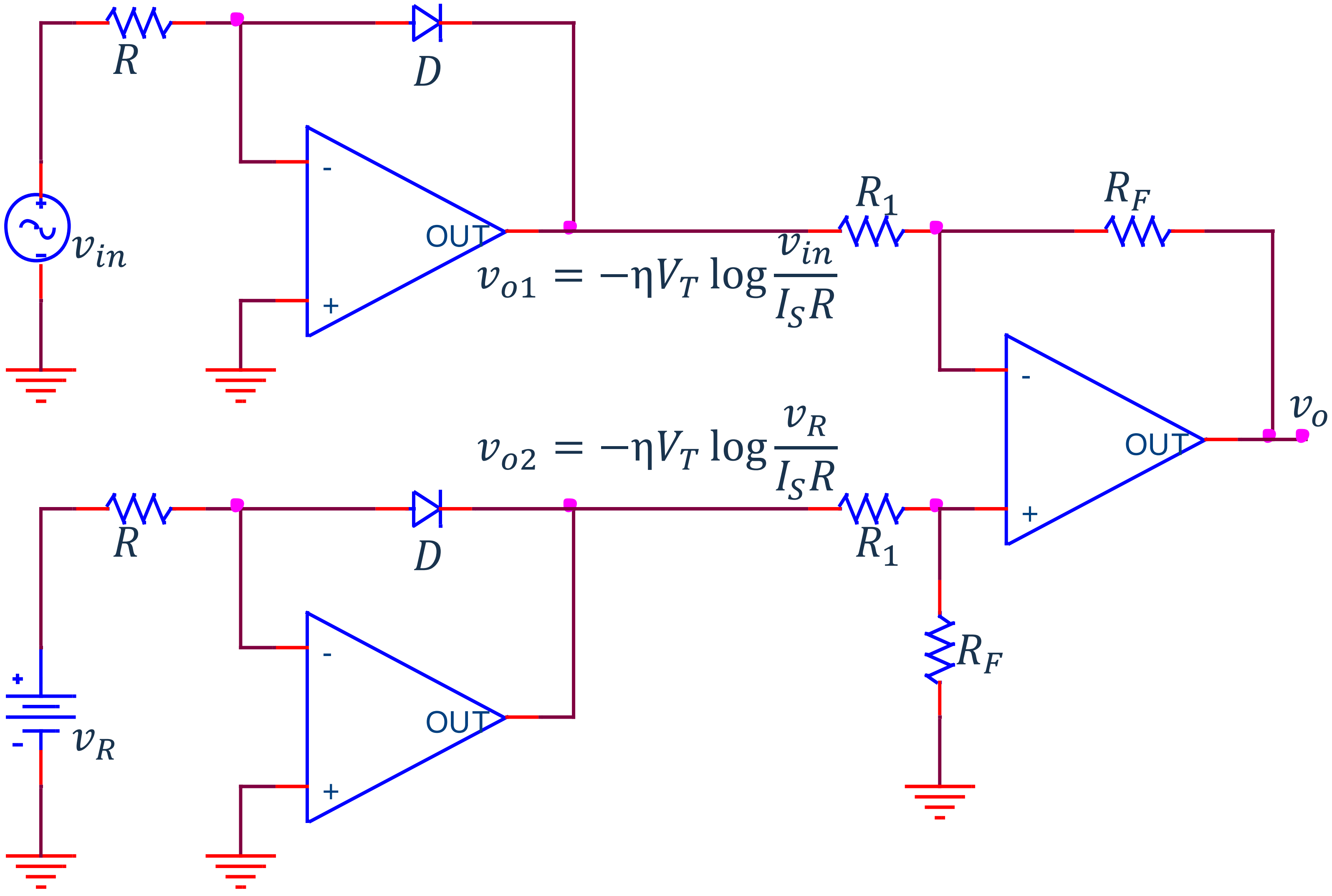
The final output voltage

$$v_o = -\frac{R_F}{R_1}(V_{o2} - V_{o1})$$

$$v_o = -\frac{R_F}{R_1}\eta V_T\left(\ln\frac{v_{in}}{I_S R} - \ln\frac{v_R}{I_S R}\right)$$

$$v_o = -\frac{R_F}{R_1}\eta V_T \ln\frac{v_{in}}{v_R}$$

Here, output v_o do not depend upon temperature dependent reverse saturation current, I_S.



Anti-logarithmic Amplifier

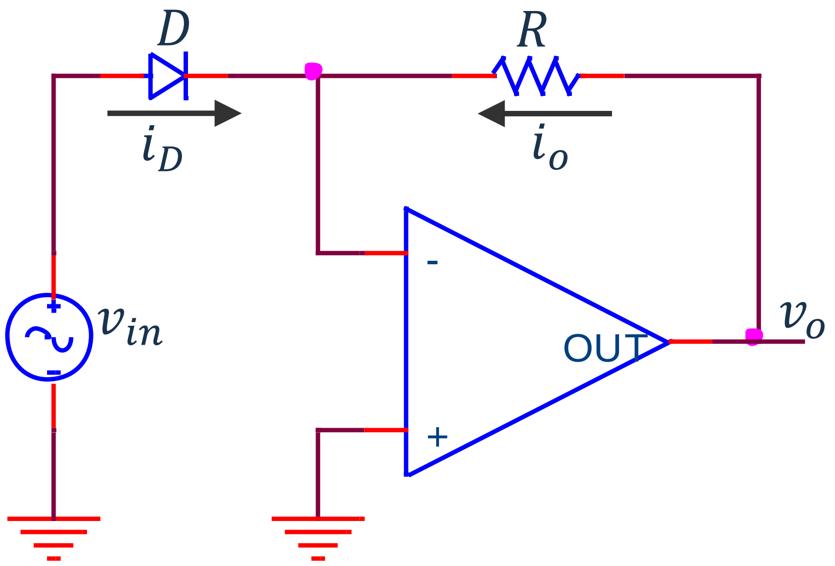
Here, diode and resistance places and exchanged and diode current is given as

$$i_D = I_S e^{\frac{v_D}{\eta V_T}}$$

Since $i_o = -i_D$, the output voltage v_o can be written as

$$v_o = i_o R = -R I_S e^{\frac{v_D}{\eta V_T}}$$

Note that v_o bears the antilog relationship with input voltage v_{in}



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Thank You

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