More HELP for HW4

\[ V_{Z} \text{ Zener Diode} \]

Voltage Regulator Reverse Bias

Sharp Reverse bias Breakdown \(-V_{BR}\)

\[ S \frac{dl_{z}}{dV_{z}} = \frac{1}{r_{z}} \]

Forward bias

\[ +V_{z} \]

\[ R_{B} \]

\[ V_{B} \]

\[ i_{z} \]

\[ \Delta V_{z} \]

\[ +i_{x} \]

\[ -V_{x} = -V_{z} \]

\[ i_{x} = -i_{z} \]

Zener diodes as

1. Voltage regulators
2. Voltage limiters

Because one can select diodes with the desired Breakdown Voltage and because low cost Zener diodes are available.

\[ \frac{dl_{x}}{dV_{x}} = \frac{1}{r_{z}} \]

approximated by straight line

\[ +V_{BK} \]

\[ V_{x} \]
Increasing $R_L$ makes the output ripple smaller and increases the ratio to source ripple. This ratio is more sensitive to $R_L$ than $R$. The local output ripple is given by $\frac{R_L}{R_L + R}$. The source ripple is $\frac{R_L}{R_L + R}$. The ratio of output voltage ripple to source ripple is $\frac{R_L + R e^{-1}}{R_L e^{-1}}$. The output ripple is $\frac{R_L}{R_L + R}$. The source ripple is $\frac{V_{source}}{V_{source}}$. The ripple is $\frac{V_{source}}{V_{source}}$. The ripple is $\frac{V_{source}}{V_{source}}$. The ripple is $\frac{V_{source}}{V_{source}}$. The ripple is $\frac{V_{source}}{V_{source}}$.
Using Zener Diode as a Voltage Regulator

\[ V_{B}(t) = V_B + V_c(t) \]

\[ V_c(t) = V_B \sin(\omega t) \]

You can select the Zener diode with a breakdown voltage \( V \).
The current $i_L$ is not equal to $i_x$.

Load voltage:

$$\Delta = \frac{2V_p R_L}{R_L + R_B}$$

Residual voltage:

$$\delta = \frac{R_Z}{\Delta} = \frac{R_Z}{R_L + R_B}$$

The source voltage perceived by the load is not $2V_p$; it is $2\frac{R_L V_p}{R_L + R_B}$.

Excess of the source voltage perceived by the load:

$$\Delta V_{in} = 2V_p$$
2. Zener diode as voltage limiters

Consider the following circuit

\[ V_{\text{out}} = \frac{R_2}{R_1 + R_2} V_{\text{IN}} \]

when \( -V_{\text{out}} < |V_{\text{BK}}| \), the branch AB is non-conducting.

\[ V_{\text{out}} \approx V_X \]

when \( V_{\text{out}} < \alpha V_X \)

\[ V_{\text{out}} \text{ does not increase much when} \]

Transfer Characteristics
Next + Consider

\[ V_{IN} \]
\[ \text{Next} \]
\[ R \]
\[ + \]
\[ - \]
\[ V_{OUT} \]
\[ V_{BK} \]
\[ |V_{BK}| \]
\[ V_{IN} \]
\[ + \]
\[ - \]
\[ R_1 \]
\[ A \]
\[ B \]
\[ C \]
\[ R_2 \]
\[ R_3 \]
\[ V_{OUT} \]
\[ AB \text{ open} \]
\[ BC \text{ open} \]
\[ V_{IN} > |V_{BK}| + V_{\delta2} \]
\[ v_{in} < |V_{BK}| + V_{\delta1} \Rightarrow \Rightarrow \frac{v_{in}}{R} \]
\[ -(|V_{BK}| + V_{\delta1}) < V_{IN} < 0 \Rightarrow CB \text{ open} + BA \text{ open} \Rightarrow \frac{v_{in}}{R} \]
\[ V_{IN} > |V_{BK}| + V_{\delta2} \quad V_{OUT} = |V_{BK}| + V_{\delta2} \quad SV_{IN} < -(|V_{BK}| + V_{\delta1}) \]
\[ \Rightarrow V_{OUT} = 1 \]
\[ V_{\text{OUT}} = V_{BK1} + V_{X2} \]

\[ -(V_{BK2} + V_{X1}) \]

\[ V_{\text{IN}} \]

What is \( V_{\text{OUT}} \) vs. \( V_{\text{IN}} \) for this circuit?