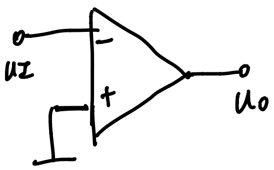
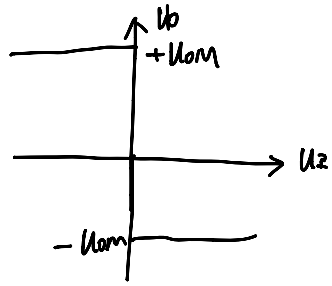
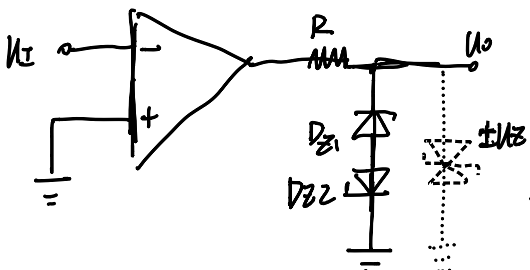
电压比较器.

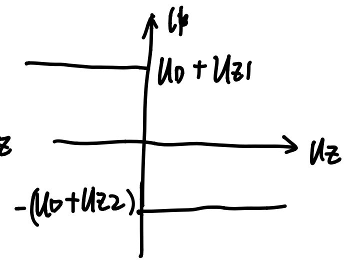
工作在非线性区；无反馈或只引入正反馈.

1. 过零比较器.





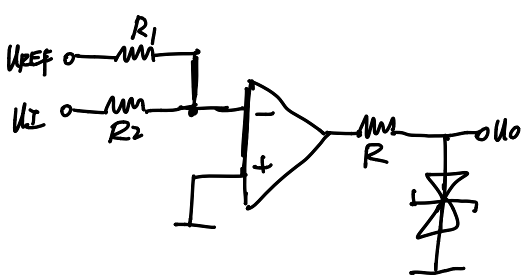


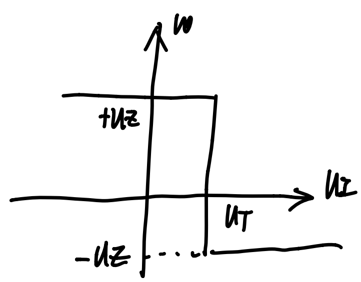


输出限幅：当 $u_O = U_{OM}$ 时 D_{Z2} 导通 压降为 U_D；D_{Z1} 反向击穿 压降为 U_{Z1}

虚线所示正反击穿电压相同.

2、一般单限比较器.

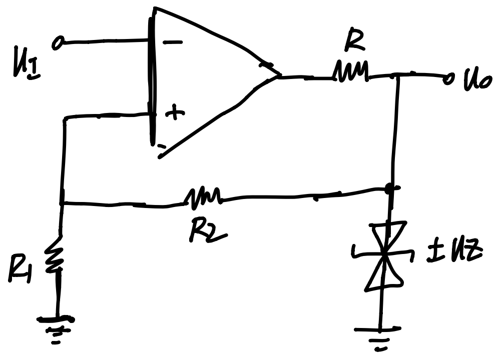


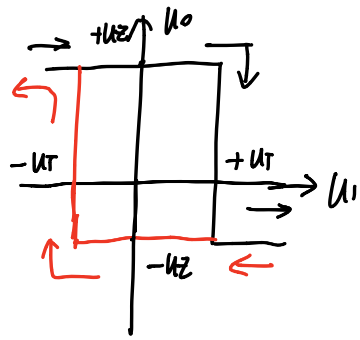


$$u_N = \frac{R_1}{R_1+R_2} u_I + \frac{R_2}{R_1+R_2} U_{REF}$$

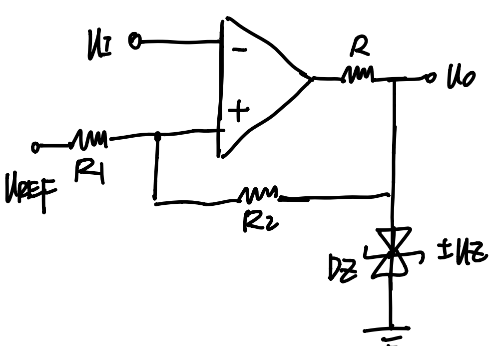
$$U_T = -\frac{R_2}{R_1} U_{REF}.$$

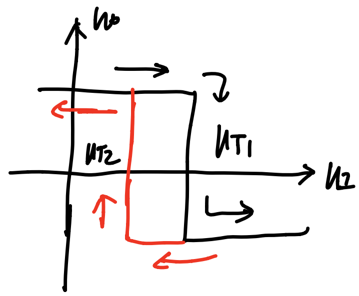
3. 滞回比较器.





$$\pm \frac{R_1}{R_1+R_2}\cdot U_Z = \pm U_T$$



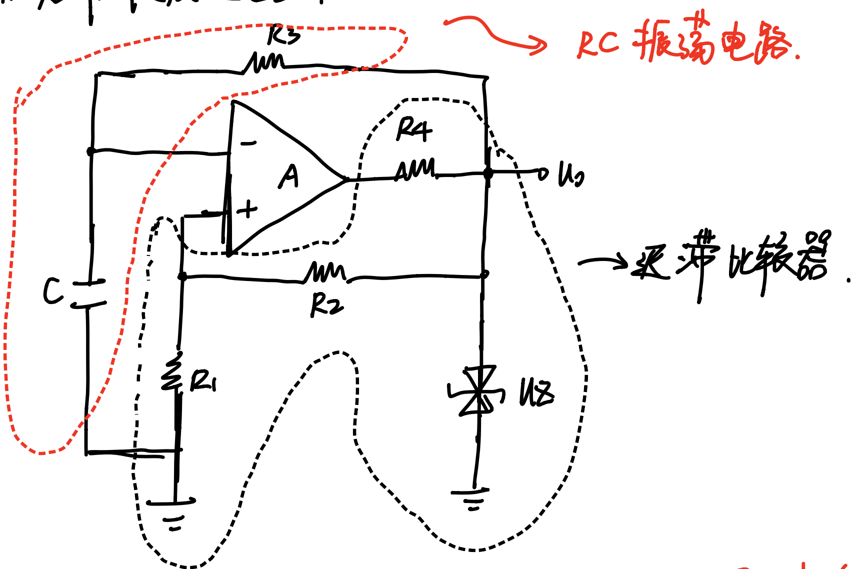


$$U_{T1} = U_{REF}\cdot\frac{R_2}{R_1+R_2} - \frac{R_1}{R_1+R_2}U_Z$$

$$U_{T2} = \frac{R_2}{R_1+R_2}U_{REF} + \frac{R_1}{R_1+R_2}U_Z$$

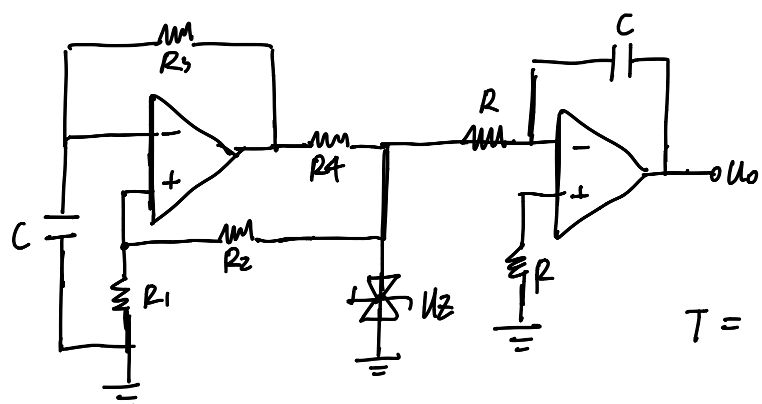
信号发生电路

1. 矩形波发生电路.



$$T = 2R_3C\ln\left(1+\frac{2R_1}{R_2}\right)$$

2、三角波发生电路.

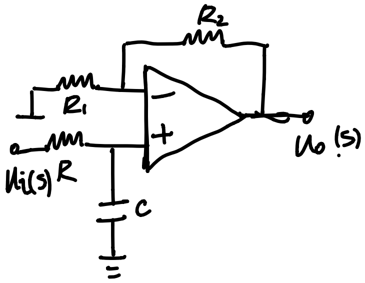


$$T = \frac{4R_1R_3C}{R_2}$$

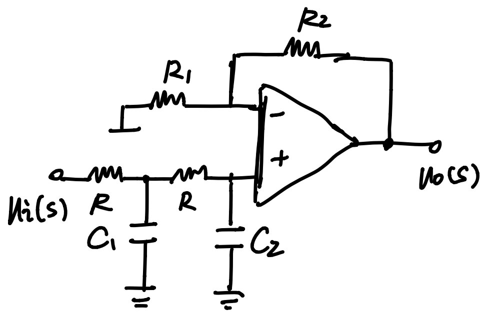
$$f = \frac{R_2}{4R_1R_3C}$$

滤波电路

1. 低通滤波电路



一阶.



二阶.

$$U_o(s) = \frac{R_P}{R_N}\cdot\frac{R_f}{R}U_i(s)$$

$$= \frac{R // \frac{1}{sC}}{R_1 // R_2}\times\frac{R_2}{R}\times U_i(s)$$

$$= \frac{\frac{\cancel{R}\times\frac{1}{sC}}{R+\frac{1}{sC}}}{\frac{R_1\cancel{R_2}}{R_1+R_2}}\times\frac{\cancel{R_2}}{\cancel{R}}\times U_i(s)$$

$$= \frac{1}{sCR+1}\times\left(1+\frac{R_2}{R_1}\right)U_i(s)$$

$$\dot{A}_u = \frac{\dot{U}_o}{\dot{U}_i} = \left(1+\frac{R_2}{R_1}\right)\times\frac{1}{1+j\omega RC}$$

$$= \left(1+\frac{R_2}{R_1}\right)\times\frac{1}{1+j\frac{f}{f_0}}$$

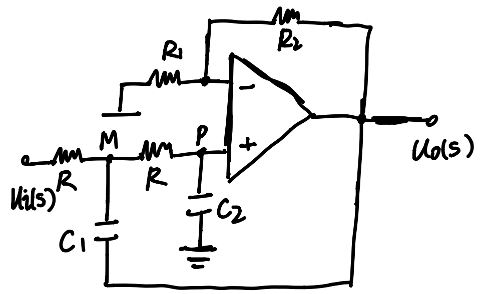
$$U_o(s) = \frac{1}{sCR+1}\times\left(1+\frac{R_2}{R_1}\right)\times\frac{\left[\frac{1}{sC}//\left(R+\frac{1}{sC}\right)\right]}{R+\left[\frac{1}{sC}//\left(R+\frac{1}{sC}\right)\right]}U_i(s)$$

$$= \left(1+\frac{R_2}{R_1}\right)\cdot\frac{1}{1+3sCR+(sRC)^2}U_i(s)$$

$$\dot{A}_u = \left(1+\frac{R_2}{R_1}\right)\times\frac{1}{1+3CR\cdot j\omega-\omega^2R^2C^2}$$

$$= \left(1+\frac{R_2}{R_1}\right)\times\frac{1}{1+3\frac{f}{f_0}-\left(\frac{f}{f_0}\right)^2}$$

$$f_p \approx 0.37 f_0.$$



压控电压源

$$\frac{U_i(s)-U_m(s)}{R}=\frac{U_m(s)-U_o(s)}{\frac{1}{sC}}+\frac{U_m(s)-U_p(s)}{R} \quad \cdots ①$$

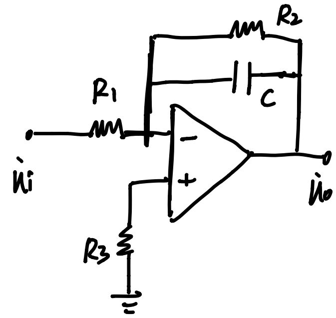
$$\frac{U_m(s)-U_p(s)}{R}=\frac{U_p(s)}{\frac{1}{sC}} \quad \cdots ②$$

$$A_u(s)=\frac{A_{up}(s)}{1+[3-A_{up}(s)]sRC+(sRC)^2}\Bigg|_{A_{up}(s)=1+\frac{R_2}{R_1}}$$

$$=\frac{\dot{A}_{up}}{1-(\frac{f}{f_0})^2+j(3-\dot{A}_{up})\frac{f}{f_0}}$$

$$Q=\frac{|\dot{A}_u|_{f=f_0}}{|\dot{A}_{up}|}=\left|\frac{1}{3-\dot{A}_{up}}\right|$$ (品质因素)

反相输入低通滤波器.



$$\dot{A}_u=\frac{-R_2 \,//\, \frac{1}{sC}}{R_1}$$

$$=-\frac{R_2\cdot\frac{1}{sC}}{(R_2+\frac{1}{sC})R_1}$$

$$=-\frac{R_2}{R_1}\cdot\frac{1}{1+sR_2C}$$