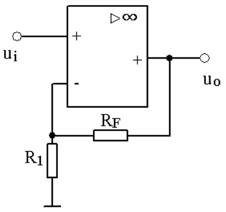
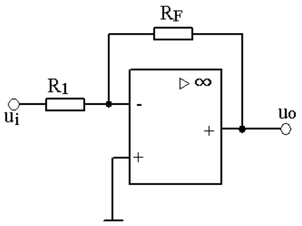
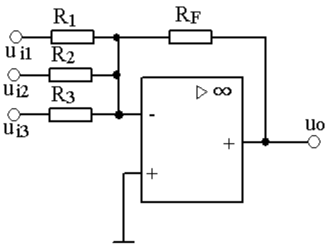
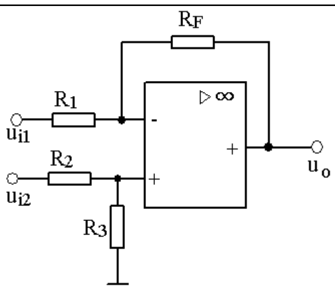
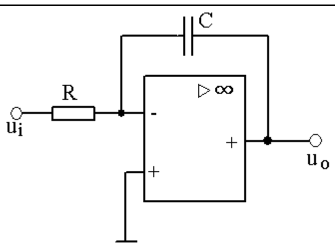
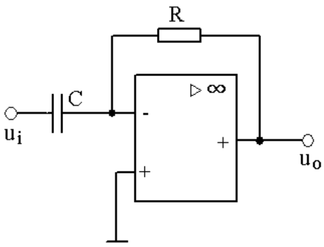
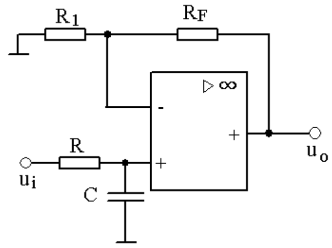
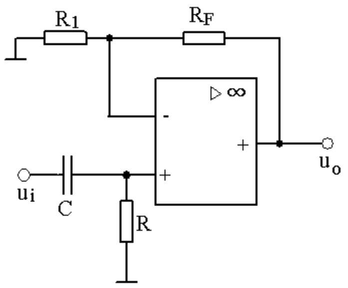
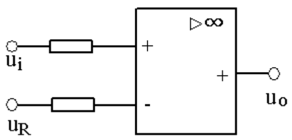
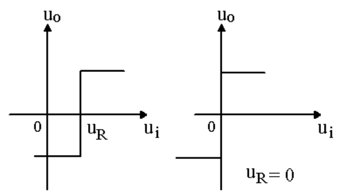
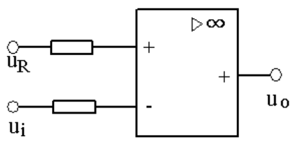
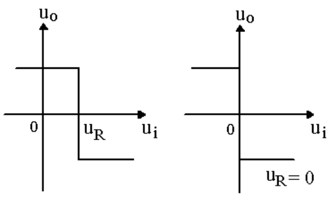
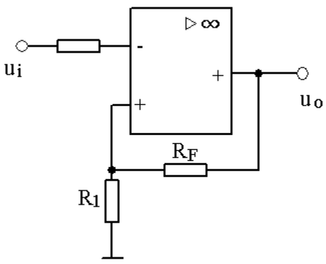
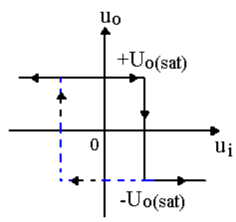
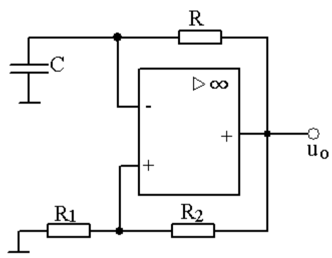
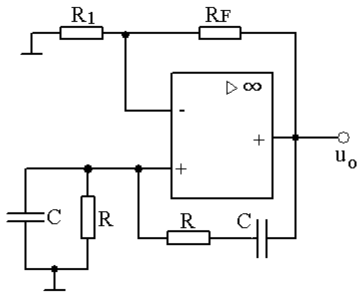
史上最全的运放典型应用电路及分析

电路名称	典型电路	分析方法	主要特征
同相比例器		$u_+ = u_i$ $u_- = \frac{R_1}{R_1 + R_F} u_o$ $\therefore \quad u_i = \frac{R_1}{R_1 + R_F} u_o$	$u_o = (1 + \frac{R_F}{R_1}) u_i$ （电压串联负反馈）
反相比例器		$u_+ = 0$ $u_- = 0$ $\frac{u_i}{R_1} = -\frac{u_o}{R_F}$	$u_o = -\frac{R_F}{R_1} u_i$ （电压并联负反馈）
反相加法运算		$u_+ = 0$ $u_- = 0$ $\frac{u_i}{R_1} + \frac{u_{i2}}{R_2} + \frac{u_{i3}}{R_3} = -\frac{u_o}{R_F}$	$u_o = -R_F(\frac{u_{i1}}{R_1} + \frac{u_{i2}}{R_2} + \frac{u_{i3}}{R_3})$
减法运算电路		$u_+ = \frac{R_3}{R_2 + R_3} u_{i2}$ $u_- = \frac{1}{R_1 + R_2}(R_1 u_o + R_F u_{i1})$ $u_+ = u_-$	$u_o = (1 + \frac{R_F}{R_1}) \frac{R_3}{R_2 + R_3} u_{i2} - \frac{R_F}{R_1} u_{i1}$ 若$R_1 = R_2 = R_3 = R_F$ $u_o = u_{i2} - u_{i1}$
积分运算电路		$u_+ = u_- = 0$ $\frac{u_i}{R} = -c\frac{du_o}{dt}$	$u_o = -\frac{1}{RC}\int u_i dt$
微分运算电路		$u_+ = u_- = 0$ $c\frac{du_i}{dt} = -\frac{u_o}{R}$	$u_o = -RC\frac{du_i}{dt}$

一阶低通滤波电路		$\dot U_- = \frac{R_1}{R_1+R_F}\dot U_o$ $\dot U_+ = \frac{\dot U_i}{R+\frac{1}{j\omega c}}\frac{1}{j\omega c}$ $\dot U_+ = \dot U_-$	$\dot U_o = \frac{1+\frac{R_F}{R_1}}{1+j\frac{\omega}{\omega_o}}\dot U_i$ $\omega_o = \frac{1}{RC}$
一阶高通滤波电路		$\dot U_- = \frac{R_1}{R_1+R_F}\dot U_o$ $\dot U_+ = \frac{R\dot U_i}{R+\frac{1}{j\omega c}}$ $\dot U_+ = \dot U_-$	$\dot U_o = \frac{1+\frac{R_F}{R_1}}{1-j\frac{\omega_0}{\omega}}\dot U_i$ $\omega_o = \frac{1}{RC}$
同相比较器		$u_i>u_R$ $u_o=+U_{o(sat)}$ $u_i=u_R$ 转折点 $u_i<u_R$ $u_o=-U_{o(sat)}$	
反相比较器		$u_i>u_R$ $u_o=-U_{o(sat)}$ $u_i=u_R$ 转折点 $u_i<u_R$ $u_o=+U_{o(sat)}$	
滞回比较器		$u_- = u_i$ $u_+ = \frac{R_1}{R_1+R_2}u_o$	
矩形波发生器		$u_+ = \frac{R_1}{R_1+R_2}u_o$ $u_- = u_C$	$T = 2RC\ln(1+\frac{2R_2}{R_1})$

RC 正弦波发生器		放大电路: $A=1+\frac{R_F}{R_1}$ 选频网络: $F=\frac{1}{3}$ $\omega_0=\frac{1}{RC}$	$f_o=\frac{1}{2\pi RC}$