Current Mirror and Amplifier

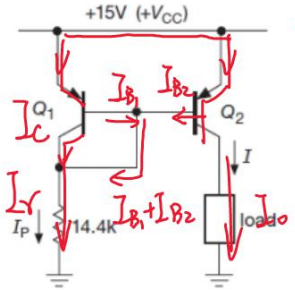


Figure 2.58. Programming current-mirror current.

$I_C + I_{B_1} = I_o + I_{B_2}$

$I_C + I_{B_1} + I_{B_2} = I_r$

$I_r - I_{B_2}$ ↗ I_o/β

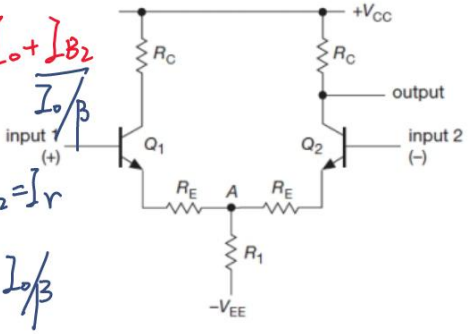
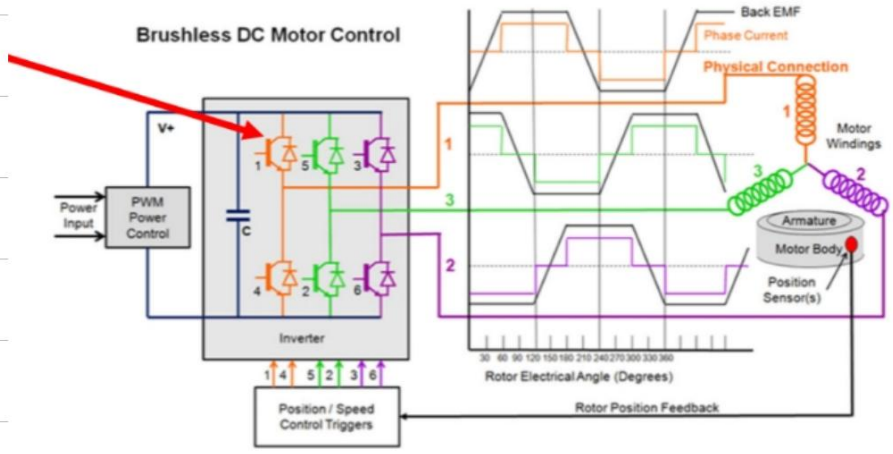


Figure 2.63. Classic transistor differential amplifier.

$I_r - I_o/\beta = I_o + I_o/\beta$

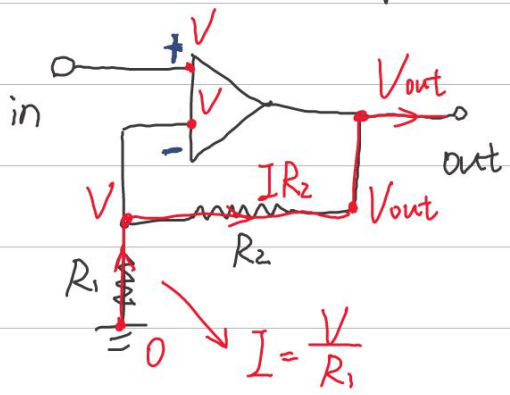
$\Rightarrow I_r = I_o(1 + \frac{2}{\beta})$

Brushless Motor speed Controller



日期： /

Operational Amplifier



$Z_{in} = \infty$

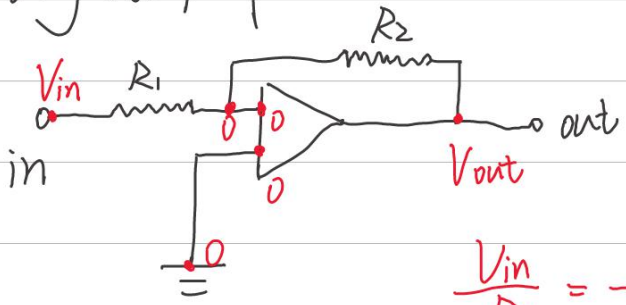
$G = 1 + \frac{R_2}{R_1}$

$I = \frac{V}{R_1}$

$V_{out} = V + \frac{V}{R_1} R_2$

$= V\left(1 + \frac{R_2}{R_1}\right)$

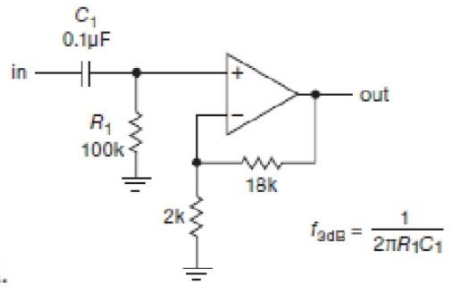
Inverting Amplifier



$\frac{V_{in}}{R_1} = -\frac{V_{out}}{R_2}$

$\Rightarrow \frac{V_{out}}{V_{in}} = \frac{-R_2}{R_1}$

应用



A.

AC signal

这有高频能通过

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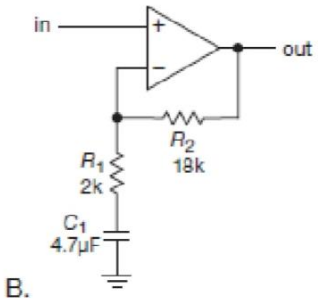


B.

DC Biased AC signal

直流交流都通过
只有交流被放大

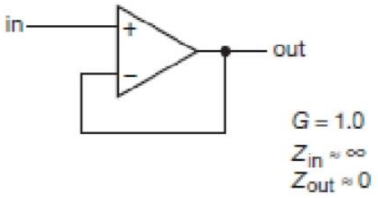
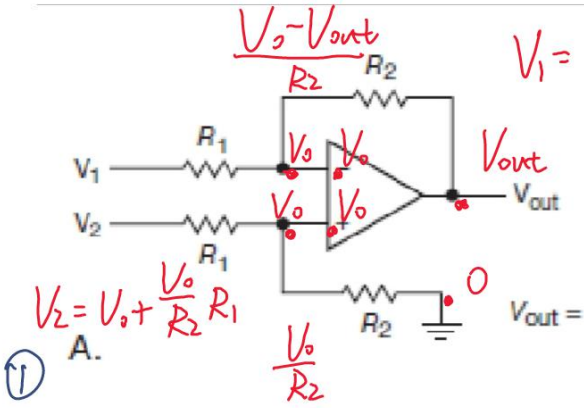


Figure 4.8. Op-amp follower.

等额



$\frac{V_o - V_{out}}{R_2}$

$V_1 = \frac{V_o - V_{out}}{R_2} R_1 + V_o$ ②

$V_2 = V_o + \frac{V_o}{R_2} R_1$

A.

①

$\frac{V_o}{R_2}$

$V_{out} = \frac{R_2}{R_1} (V_2 - V_1)$

① ② $\Rightarrow \frac{R_2}{R_1}(V_2 - V_1)$

差值放大

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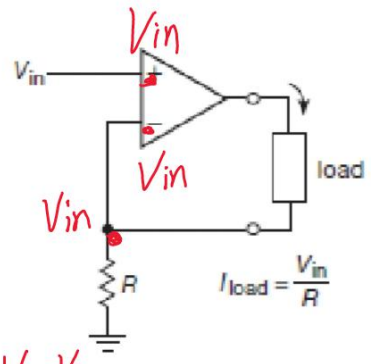
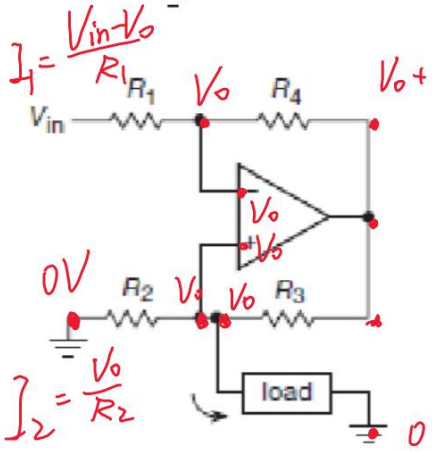


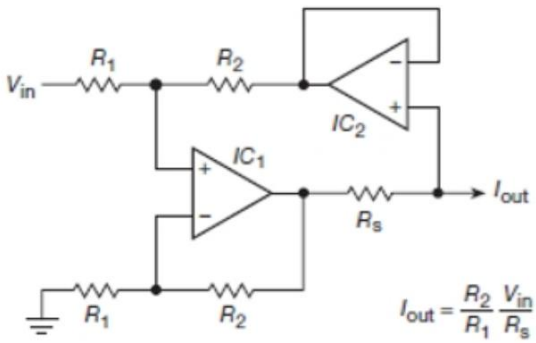
电流源



$$\frac{R_3}{R_2} = \frac{R_4}{R_1}$$

$$I_{out} = -\frac{V_{in}}{R_2}$$

$$Z_{out} = R_3 \frac{100\%}{\%\ \text{mismatch}}$$



$$I_{out} = \frac{R_2}{R_1}\frac{V_{in}}{R_s}$$

日期：　　/

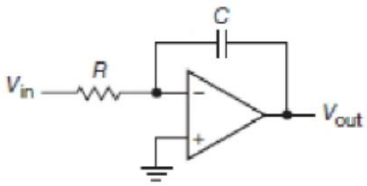


Figure 4.16. Integrator.

$$V_{in}/R = -C(dV_{out}/dt)$$

$$V_{out}(t) = -\frac{1}{RC}\int V_{in}(t)\,dt + \text{const.}$$

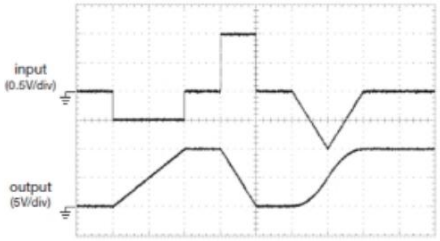
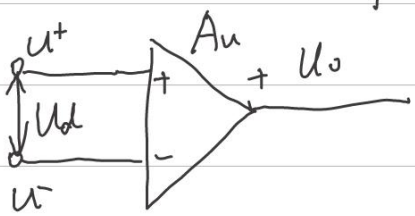


Figure 4.17. Integrator waveforms. The output can go anywhere it wants to, unlike our simple *RC* "integrator" of §1.4.4. Horizontal: 10 ms/div.

积分电路

理想运放电路分析



$u_o = A_u(u^+ - u^-)$
$= A_u u_d$

① 输入端相当于断路　② 两输入端等电压
③ 一方接地，另一方相当于接地