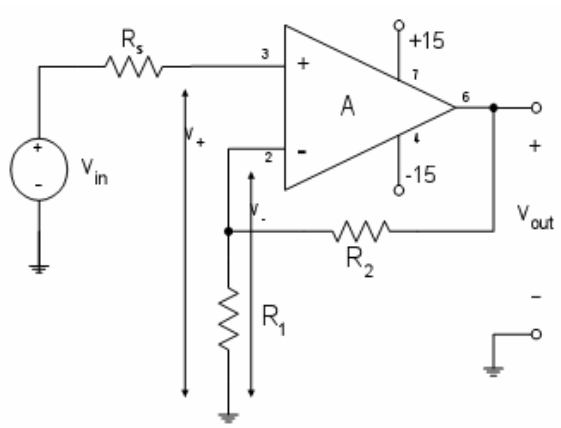
同相放大器增益分析

使用有限开环增益例子

参考图 7 的 Motorola MC 1741C 特性：开环频率响应



令 $R_s = 0$; 因此 $v_+ = v_{in}$

$v_- = \frac{R_1}{R_1 + R_2} \times v_{out}$; 但 $v_+ = v_-$

所以 $v_{in} = \frac{R_1}{R_1 + R_2} \times v_{out}$;

$\frac{v_{out}}{v_{in}} = \frac{R_1 + R_2}{R_1}$

或 $A_v = 1 + \frac{R_2}{R_1}$

无限大开环增益分析

1 Hz, 1000 Hz, 和 10kHz 处的例子

电压增益A_V=40dB = 100; R_2= 100kΩ, R_1= 1kΩ; [OK 101 = 40.1dB!]

1. 在 1 Hz处, A_{vol} = 100 dB = 1 x 10^5 = 100,000.

$$A_V = \frac{A}{1 + A\beta} = \frac{10^5}{1 + 10^5 \times .01} = \frac{10^5}{10^3} = 100 = 40dB$$

注意: A_β = 10^3 = 60 dB; 60 dB 开环增益 + 40 dB 闭环增益 = 100 dB 总增益

2. 在1000 Hz处, A_{vol} = 60 dB = 10^3 = 1000 .

$$A_V = \frac{A}{1 + A\beta} = \frac{10^3}{1 + 10^3 \times .01} = \frac{10^5}{10 + 1} = \frac{1000}{11} = 90.9 = 39..2dB$$

注意: A_β = 10^1 = 20 dB; 20 dB 开环增益 + 40 dB 闭环增益= 60 dB 总增益

3. 在10 kHz处, A_{vol} = 42 dB = 1.26 x 10^2 = 126.

$$A_V = \frac{A}{1 + A\beta} = \frac{126}{1 + 126 \times .01} = \frac{126}{1 + 1.26} = \frac{126}{2.26} = 55.8 = 34.9dB$$

注意: A_β = 1.26 = 2.0 dB; 2 dB 开环增益 + 40 dB闭环增益= 42 dB 总增益