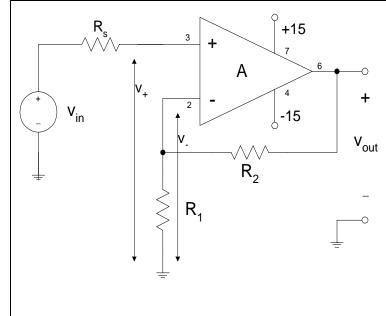
NON-INVERTING AMPLIFIER GAIN ANALYSIS using FINITE OPEN LOOP GAIN examples

Refer to Figure 7 of the Motorola MC 1741C spec: Open-Loop Frequency Response $Let \ R_{s} = 0; \ Therefore \ v_{+} = v_{in}$



Let
$$R_s = 0$$
; Therefore $v_+ = v_{in}$

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

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

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

$$or \quad A_v = 1 + \frac{R_2}{R_1}$$

FINITE OPEN-LOOP GAIN ANALYSIS:

Examples at 1 Hz, 1000 Hz, and 10kHz

Voltage gain A_v =40dB = 100; R_2 = 100k Ω , R_1 = 1k Ω ; [OK 101 = 40.1dB!]

1. At 1 Hz, $A_{\text{vol}} = 100 \text{ dB} = 1 \times 10^5 = 100,000$. [From the gain-bandwidth curve for the device.]

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

Note: $A\beta = 10^3 = 60 \text{ dB}$; 60 dB loop gain + 40 dB closed loop gain = 100 dB total gain

2. At 1000 Hz, $A_{vol} = 60 \text{ dB} = 10^3 = 1000$.

$$A_{\nu} = \frac{A}{1 + A\beta} = \frac{10^3}{1 + 10^3 \times .01} = \frac{10^3}{1 + 10} = \frac{1000}{11} = 90.9 = 39.2 \, dB$$

Note: $A\beta = 10^1 = 20 \text{ dB}$; 20 dB loop gain + 40 dB closed loop gain = 60 dB total gain

3. At 10 kHz, $A_{vol} = 42 \text{ dB} = 1.26 \text{ x } 10^2 = 126$.

$$A_v = \frac{A}{1+AB} = \frac{126}{1+126 \times .01} = \frac{126}{1+1.26} = \frac{126}{2.26} = 55.8 = 34.9 \, dB$$

Note: $A\beta = 1.26 = 2.0 \text{ dB}$; 2 dB loop gain + 40 dB closed loop gain = 42 dB total gain

Page 1of 1

10/15/03

Cite as: Ron Roscoe, course materials for 6.101 Introductory Analog Electronics Laboratory, Spring 2007. MIT OpenCourseWare (http://ocw.mit.edu/), Massachusetts Institute of Technology. Downloaded on [DD Month YYYY].