電子電路實驗 5：Multi-Pole Feedback Network OP-Amp Circuit

實驗預報

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October 11, 2015

1 Objectives

1. To analyze the theory of feedback network in the multi-pole OP-Amp circuit.
2. To discuss the issue of stability for the feedback amplifier.
3. To understand the physical meaning of sinusoidal vibration.

2 Procedures

2.1 DC Functional Confirmation of A_1

1. Reference pin voltage for A_1, check $V_{pin7}, V_{pin4}, V_{pin2}, V_{pin3}, V_{pin6}$.
2. Record these values.

2.2 DC Functional Confirmation A_2

1. Use $R = 10\,\mathrm{k\Omega}, r = 100\,\Omega, C_1 = 0.1\,\mu\mathrm{F}$ for A_2.
2. Supply voltage source $V_{CC} = +15\,\mathrm{V}$, and $-V_{CC} = -15\,\mathrm{V}$ to the circuit.
3. Reference pin voltage for A_2, check $V_{pin7}, V_{pin4}, V_{pin2}, V_{pin3}, V_{pin6}$.
4. Record these values.

2.3 Small Signal Analysis

1. Use $R = 10\,\mathrm{k\Omega}, r = 100\,\Omega, C_1 = 0.1\,\mu\mathrm{F}$ for A_2.
2. Supply voltage source $V_{CC} = +15\,\mathrm{V}$, and $-V_{CC} = -15\,\mathrm{V}$ to the circuit.
3. Apply the input small signal V_i to the breadboard by using function generator to generate $v_i = v_{ac}\sin(2\pi ft), 2v_{ac} = 100\,\mathrm{mV}_{(p-p)}, f = 100\,\mathrm{Hz}$.

4. Make sure that the v_i is measured from the breadboard by using the probe from `CH1` in oscilloscope.
5. oscilloscope ▷Press the `CH1` and `CH2` `MENU` ▷`Coupling` ▷`AC`.
6. Observe $V_{i(p-p)}$ and $V_{o(p-p)}$ in `CH1` and `CH2`, respectively.
7. Keep the previous adjustment of V_i constantly.
8. Record the voltage gain A_M in the oscilloscope.
9. Function generator ▷Adjust Frequency and observe the voltage gain A_V in oscilloscope until $A_v = 0.707A_M$.
10. Record the frequency f_{3dB}.

2.4 DC Functional Confirmation of A_3

1. Short terminal `D` to the ground.
2. Reference pin voltage for A_3, check $V_{pin7}, V_{pin4}, V_{pin2}, V_{pin3}, V_{pin6}$.
3. Record these values.

2.5 DC Functional Confirmation of A_4

1. Short terminal `E` to the ground.
2. Reference pin voltage for A_4, check $V_{pin7}, V_{pin4}, V_{pin2}, V_{pin3}, V_{pin6}$.
3. Record these values.

2.6 Initial state of the feedback network circuit

1. Use $R = 10\,\mathrm{k\Omega}, r = 100\,\Omega, C_1 = C_2 = C_3 0.1\,\mu\mathrm{F}, VR = 10\,\mathrm{k\Omega}$.
2. adjust VR to have $R_{p1} = 0\,\Omega, R_{p2} = 10\,\mathrm{k\Omega}$.
3. Apply the input signal v_i to the breadboard by using function generator to generate $v_i = v_{ac}\,\mathrm{square}(2\pi ft), 2v_{ac} = 5\,\mathrm{V}_{(p-p)}, f = 0$~10Hz. circuit.
4. Make sure that the v_i is **measured from the breadboard** by using the probe from `CH1` in oscilloscope.
5. Oscilloscope ▷Press the `CH1` and `CH2` `MENU` ▷`Coupling` ▷`DC`.
6. Observe whether the waveform shown in `CH1` and `CH2` distort.

2.7 Vibration observation of the circuit

1. Keep the previous adjustment in step 7 constantly.
2. Observe the waveform of $V_{o(p-p)}$ in `CH2` when slowly increasing the value of R_{p1} until the sinusoidal vibration occur.
3. As the sinusoidal vibration occur, record $V_{S(p-p)}, V_{J(p-p)}, V_{o(p-p)}, f_o, R_{p1}, R_{p2}$.

4. During the adjustment of appearing sin-vibration, observe whether the waveform of $V_{o(p-p)}$ occur damping phenomenon.