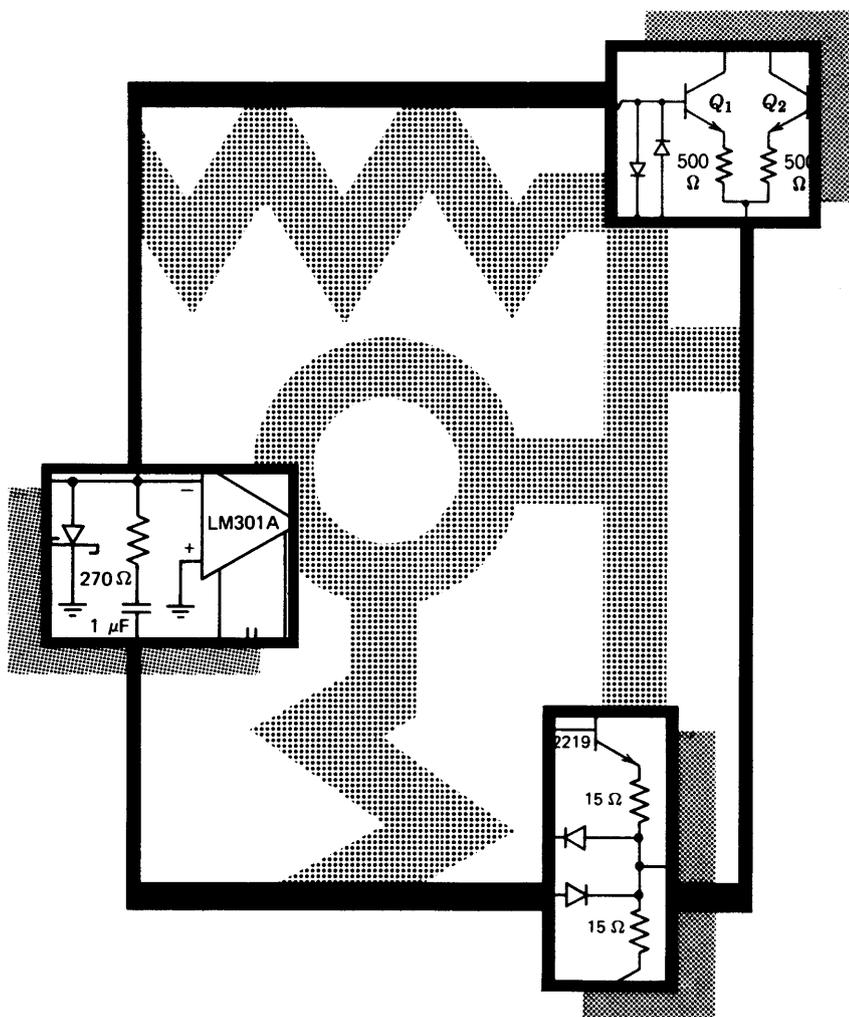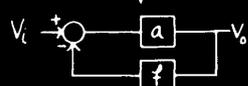# Feedback Compensation | 11

Blackboard 11.1

Feedback Compensation
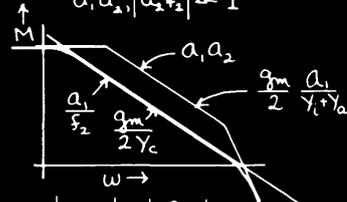
$$\frac{V_o}{V_a} = a_1 \frac{a_2}{1 + a_2 f_2}$$

$$\simeq \frac{a_1}{f_2}, \; |a_2 f_2| \gg 1$$

$$\simeq a_1 a_2, \; |a_2 f_2| \ll 1$$

$$\frac{V_o}{V_a} = a_1 \frac{a_2}{1 + a_2 f_2}$$

$$\frac{V_o}{V_i} = \frac{a_1 \frac{a_2}{1 + a_2 f_2}}{1 + a_1 f_1 \frac{a_2}{1 + a_2 f_2}}$$

If $|a_2 f_2 (j\omega)| \gg 1$
design using

$$-L.T. \cong \frac{a_1 f_1}{f_2}$$

$$\text{If } \left| a_1 a_2 \right| > \left| \frac{a_1}{f_2} \right|$$

$$\left| a_2 f_2 \right| > 1$$

11-1

Blackboard 11.2
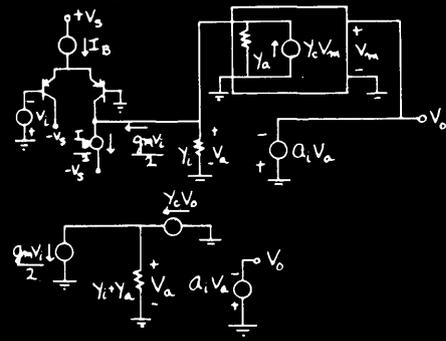
$$-\frac{g_m V_i}{2} = (Y_i + Y_a) V_a - Y_c V_o$$

$$0 = a_i V_a + V_o$$

$$\frac{V_o}{V_i} = \frac{\frac{g_m}{2} \frac{a_i}{Y_i + Y_a}}{1 + \frac{a_i Y_c}{Y_i + Y_a}}$$

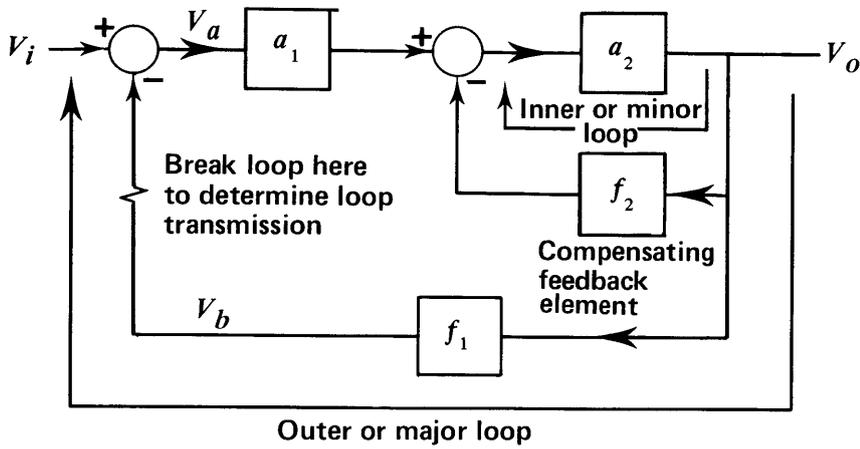$$\frac{V_o}{V_i} \simeq \frac{g_m}{2 Y_c}, \; \left| \frac{a_i Y_c}{Y_i + Y_a} \right| \gg 1$$

$$\frac{V_o}{V_i} \simeq \frac{g_m}{2} \frac{a_i}{Y_i + Y_a}, \; \left| \frac{a_i Y_c}{Y_i + Y_a} \right| \ll 1$$

$$\text{If } \left| \frac{g_m a_i}{2(Y_i + Y_a)} \right| > \frac{g_m}{2 Y_c},$$
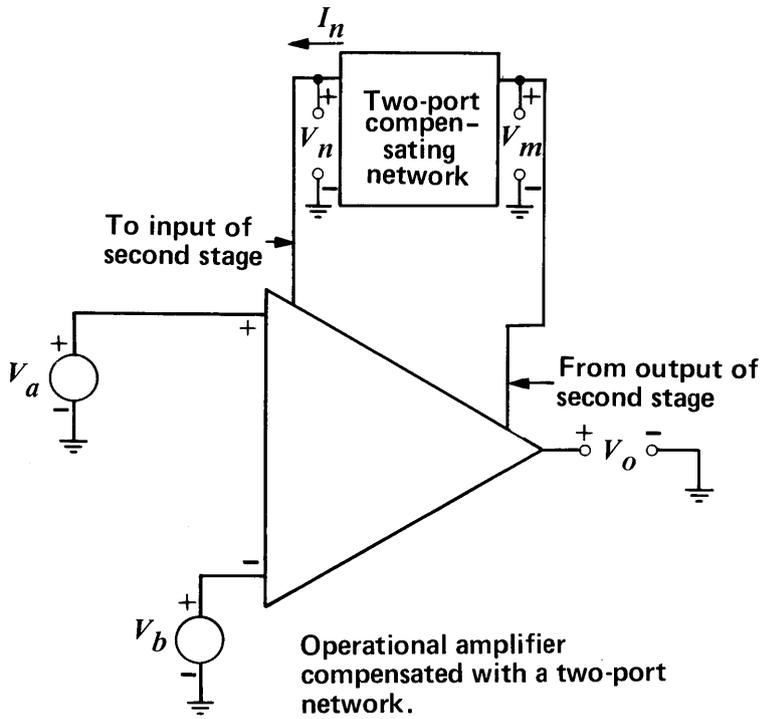
$$\left| \frac{a_i Y_c}{Y_i + Y_a} \right| > 1$$

11-2

Topology for feedback compensation

Viewgraph 11.1

Outer or major loop

Viewgraph 11.2

Operational amplifier compensated with a two-port network.

Comments

Minor-loop compensation provides a preferable alternative to cascade compensation for many physical systems. Examples include servomechanisms using tachometric feedback and a number of available integrated-circuit operational amplifiers.

The appropriate compensation for a particular application is generally determined by assuming that feedback controls the behavior of the minor loop at the major-loop crossover frequency. The possibility is realistic because the relatively fewer elements included in the minor loop permit it to have a higher crossover frequency.

Reading

Textbook: Sections 5.3 and 13.3.1.

Problem

Problem 11.1 (P5.14)

RES.6-010 Electronic Feedback Systems
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