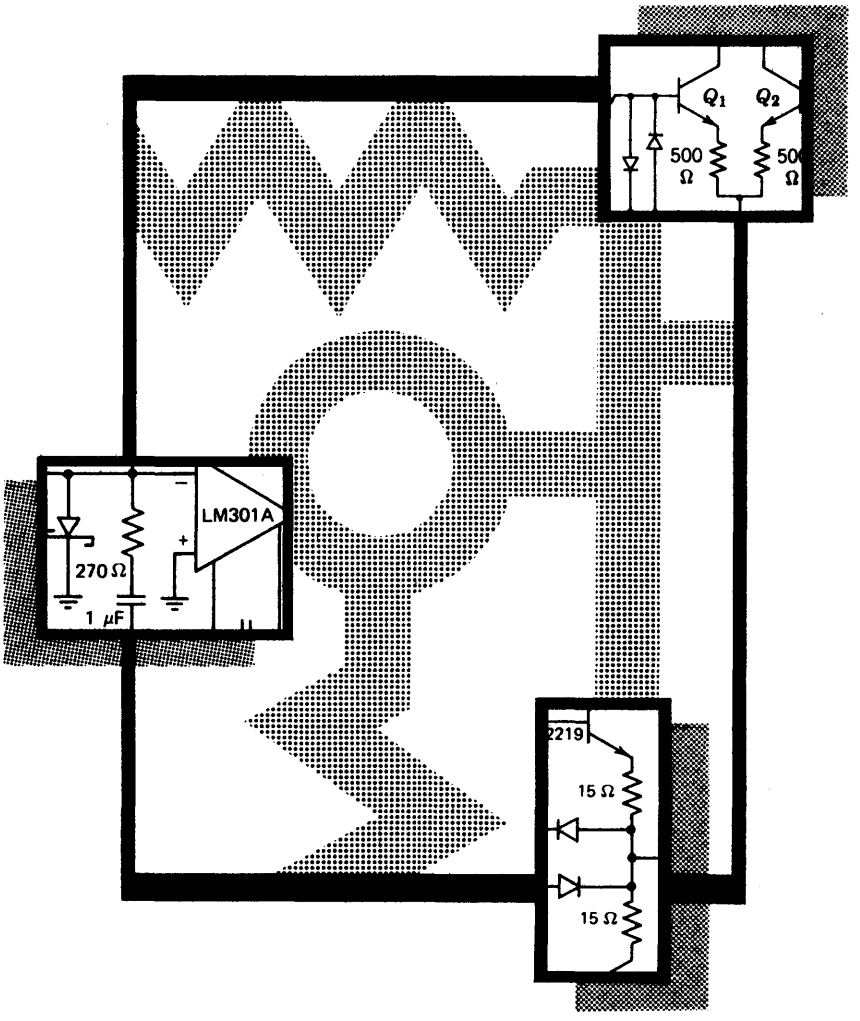
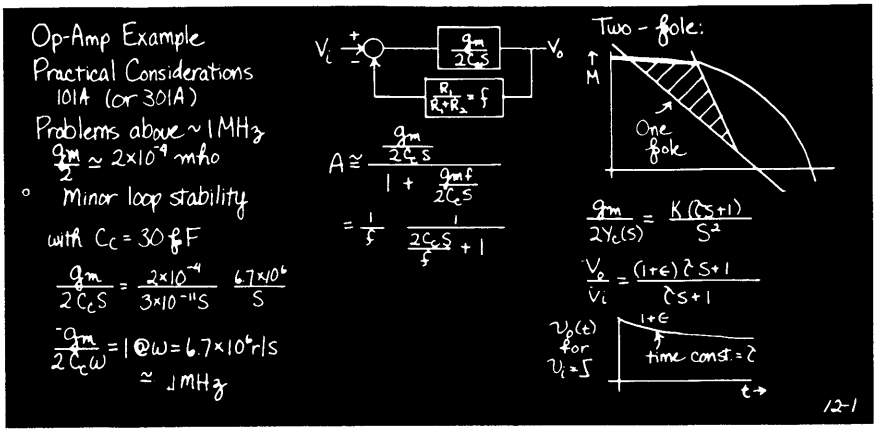
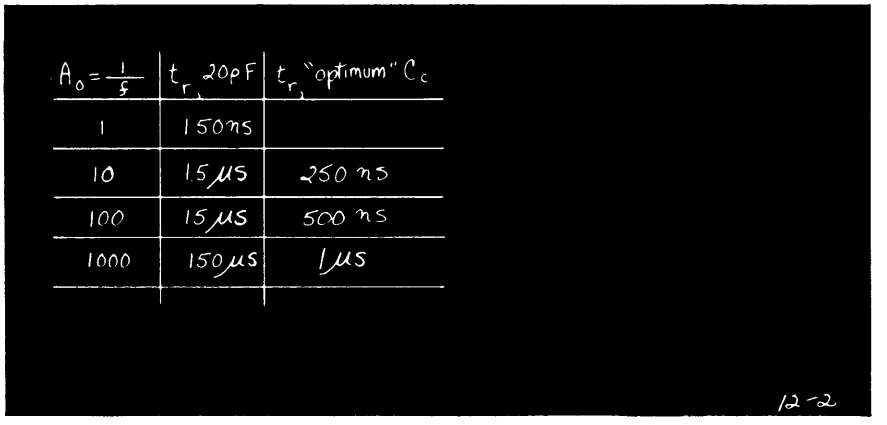
12 Feedback Compensation of an Operational Amplifier



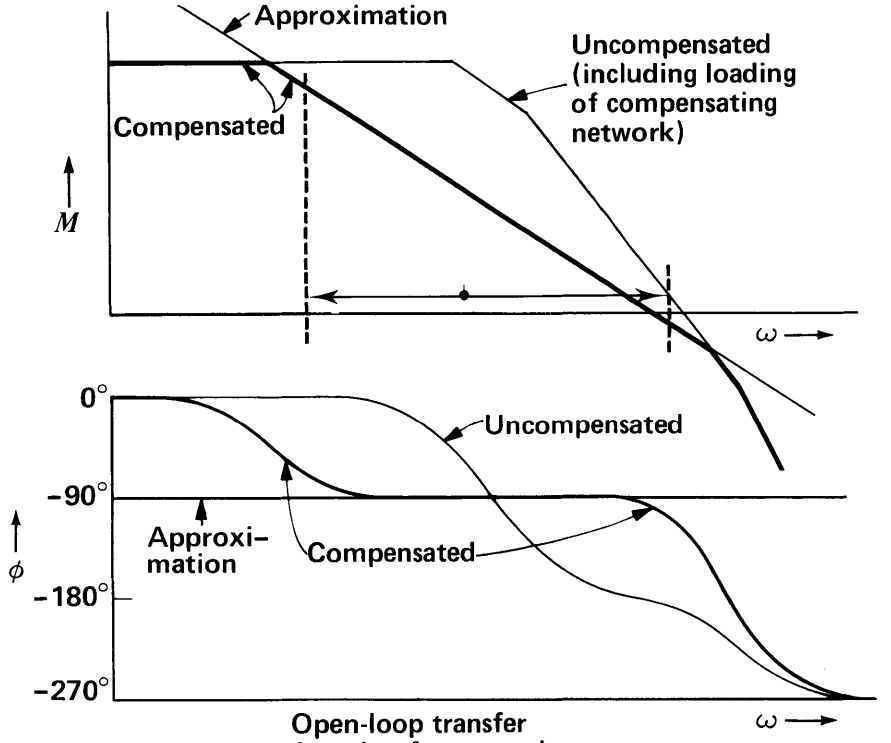
Blackboard 12.1



Blackboard 12.2

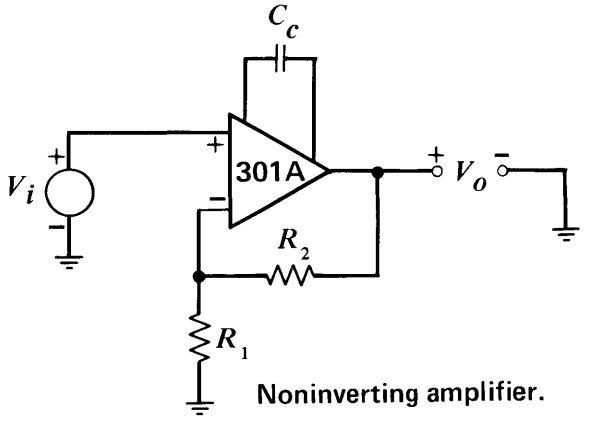


Viewgraph 12.1



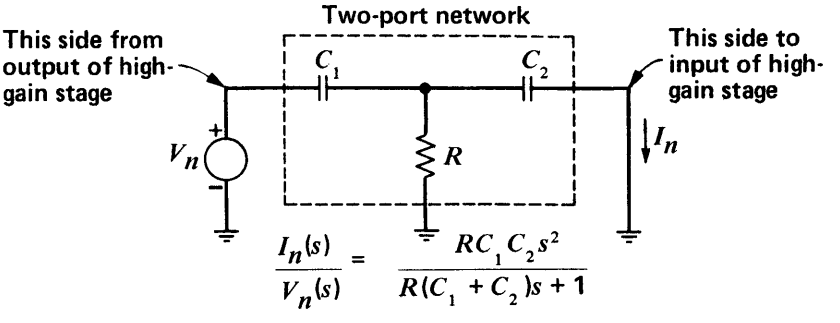
Open-loop transfer function for one-pole compensation.

Viewgraph 12.2



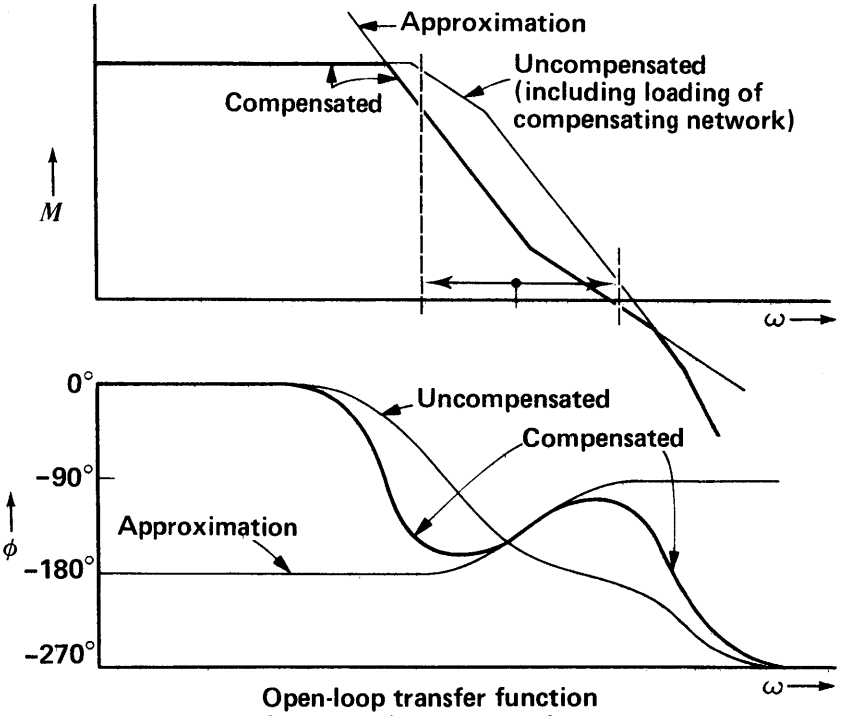
Noninverting amplifier.

Viewgraph 12.3



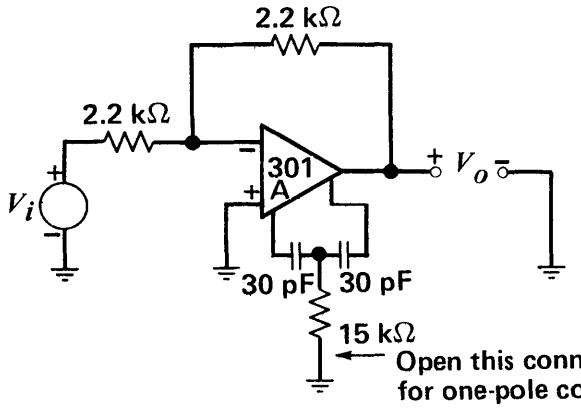
Network for two-pole compensation

Viewgraph 12.4



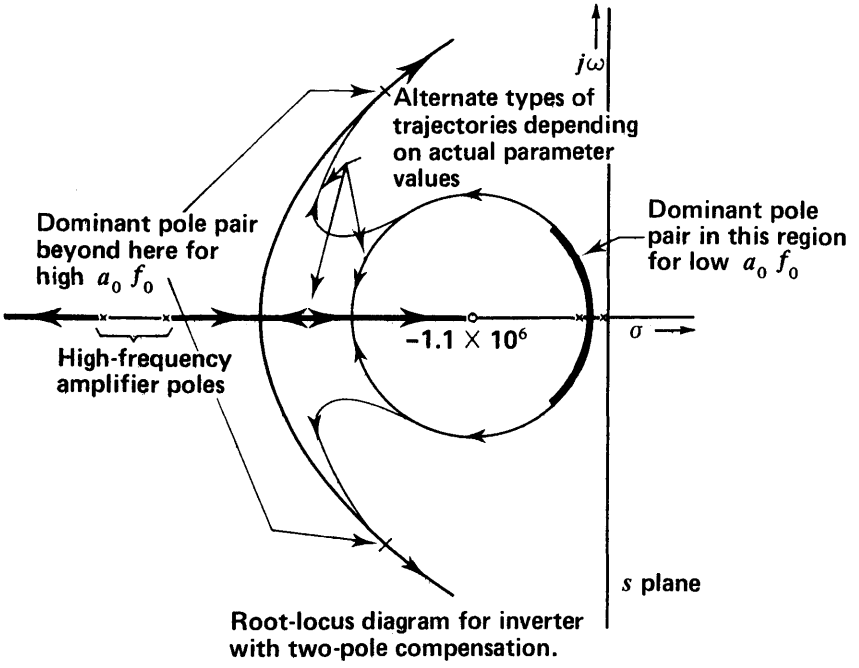
Open-loop transfer function for two-pole compensation.

Viewgraph 12.5



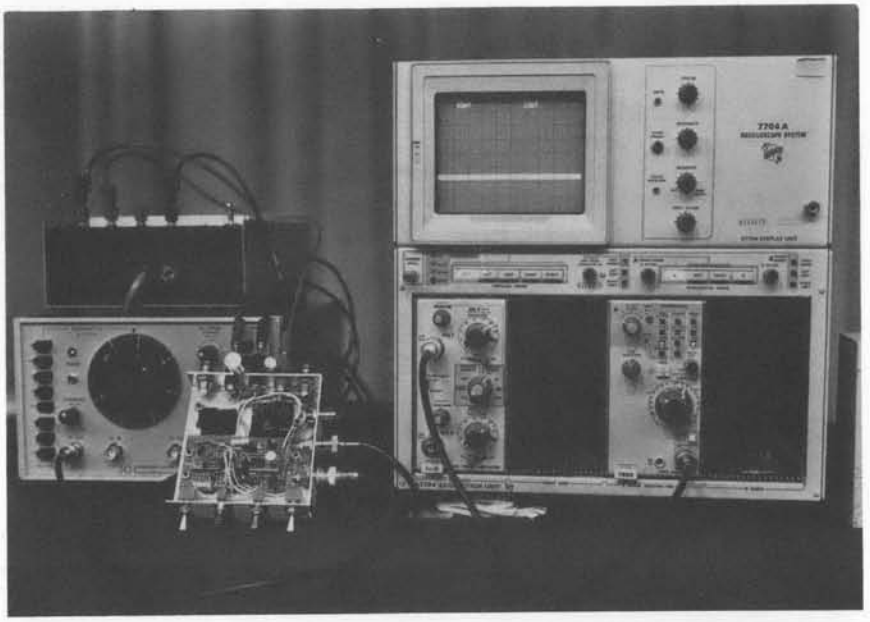
Unity-gain inverter with two-pole compensation.

Viewgraph 12.6

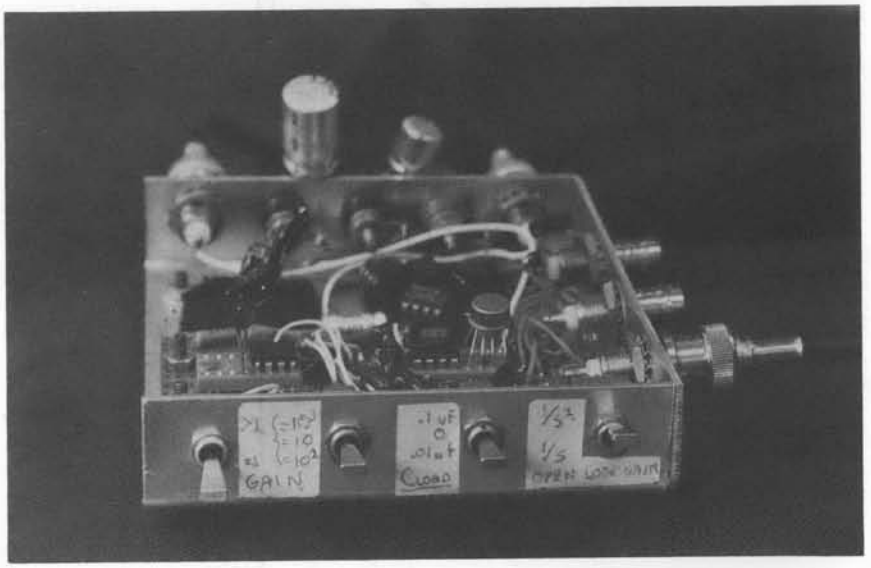


Root-locus diagram for inverter with two-pole compensation.

Demonstration Photograph
12.1 Operational-amplifier compensation demonstration



Demonstration Photograph
12.2 Close-up of operational-amplifier for compensation circuit



Comments

In this session we show how minor-loop compensation is used to control the dynamics of an available integrated-circuit operational amplifier. We find that in certain applications, dramatic performance improvements are possible compared with a similar amplifier that uses fixed compensation that is selected for unity-gain stability.

While specific values for the compensating components are selected based on parameters of the amplifier type used, the general methods are applicable to any amplifier that allows the choice of the components used for minor-loop compensation.

Correction

In about the middle of the first blackboard I give the expression for the closed-loop gain as:

$$A \simeq \frac{\frac{g_m}{2C_c s}}{1 + \frac{g_m f}{2C_c s}} = \frac{1}{f} \frac{1}{\frac{2C_c s}{f} + 1}$$

The final expression should read:

$$\frac{1}{f} \frac{1}{\frac{2C_c s}{g_m f} + 1}$$

(There is a g_m missing in the equation on the blackboard.)

Reading

Textbook: Sections 13.3.2 and 13.3.3.

Problems

Problem 12.1 (P13.5)

Problem 12.2 (P13.6)

Problem 12.3 (P13.7)

Problem 12.4 (P13.8)

RES.6-010 Electronic Feedback Systems

Spring 2013