Unit -> 1 Diode Circuits

Subject -> Analog Circuits

Faculty -> Dr Nidhi chauhan

Paper code -> BT 402

Lecture 2 -> Voltage and Current amplifier

6.1 Background

Feedback plays an important role in almost all electronic circuits. It is almost invariably used in the amplifier to improve its performance and to make it more ideal. In the process of feedback, a part of output is sampled and fed back to the input of the amplifier. Therefore, at input we have two signals : Input signal, and part of the output which is fed back to the input. Both these signals may be in phase or out of phase. When input signal and part of output signal are in phase, the feedback is called **positive feedback**. On the other hand, when they are in out of phase, the feedback is called **negative feedback**. Use of positive feedback results in oscillations and hence not used in amplifiers.

In this chapter, we introduce the concept of feedback and show how to modify the characteristics of an amplifier by combining a portion or part of the output signal with the input signal.

➢ Test your Understanding

1. *In positive feedback input signal and part of output signal are ....*

6.2 Classification of Amplifiers

Before proceeding with the concepts of feedback, it is useful to understand the classification of amplifiers based on the magnitudes of the input and output impedances of an amplifier relative to the source and load impedances, respectively. The amplifiers can be classified into four broad categories : voltage, current, transconductance and transresistance amplifiers.

6.2.1 Voltage Amplifier

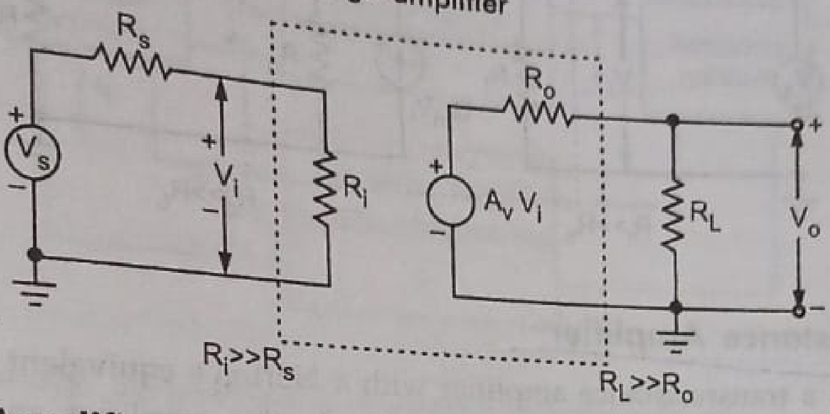
Fig. 6.1 shows a Thevenin's equivalent circuit of an amplifier.

If the amplifier input resistance R_i is large compared with the source resistance R_s then $V_i \approx V_s$. If the external load resistance R_L is large compared with the output resistance R_o of the amplifier then $V_o \approx A_v V_i \approx A_v V_s$. Such amplifier circuit provides a voltage output proportional to the voltage input, and the proportionality factor does not depend on the magnitudes of the source and load resistances. Hence, this amplifier is called

voltage amplifier. An ideal voltage amplifier must have infinite input resistance R_i and zero output resistance R_o. For practical voltage amplifier we must have $R_i >> R_s$ and $R_L >> R_o$.

▶ **Figure 6.1**

Thevenin's equivalent circuits of a voltage amplifier

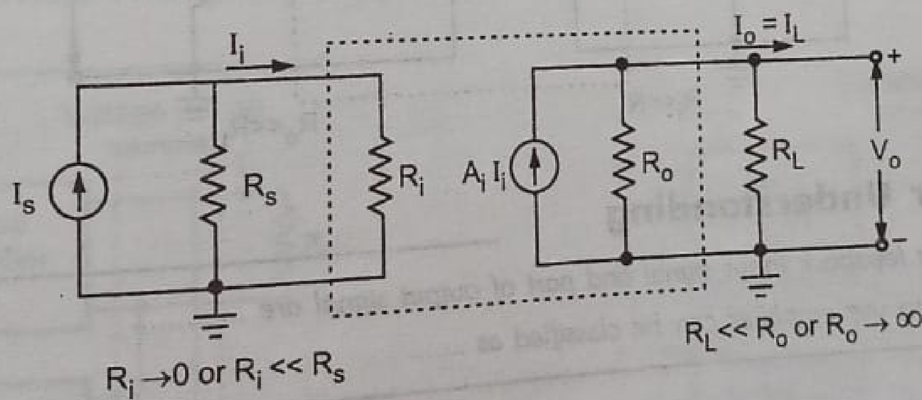


6.2.2 Current Amplifier

Fig. 6.2 shows Norton's equivalent circuit of a current amplifier. If amplifier input resistance $R_i \rightarrow 0$, then $I_i \approx I_s$. If amplifier output resistance $R_o \rightarrow \infty$, then $I_L = A_i I_i$. Such amplifier provides a current output proportional to the signal current, and the proportionality factor is independent of source and load resistances. This amplifier is called **current amplifier.** An ideal current amplifier must have zero input resistance R_i and infinite output resistance R_o. For practical current amplifier we must have $R_i << R_s$ and $R_o >> R_L$.

▶ **Figure 6.2**

Norton's equivalent circuits of a current amplifier



6.2.3 Transconductance Amplifier

Fig. 6.3 shows a transconductance amplifier with a Thevenin's equivalent in its input circuit and Norton's equivalent in its output circuit. In this amplifier, an output current is proportional to the input signal voltage and the proportionality factor is independent of the magnitudes of the source and load resistances. Ideally, this amplifier must have an infinite input resistance R_i and infinite output resistance R_o. For practical transconductance amplifier we must have $R_i >> R_s$ and $R_o >> R_L$.