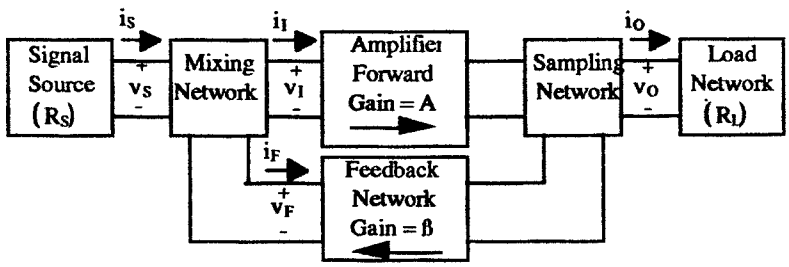
Feedback Analysis of Transistor Amplifiers

Transistor amplifiers with negative feedback can be approximately analyzed using the following rules. The success of this approximate method depends on how well the loop can be opened without affecting the A and ß networks. The method is based on the two-terminal representation of a single-loop negative feedback amplifier.



1.) Identify the feedback topology.

a.) Identify the feedback loop by tracing the signal flow from a starting point in the loop, in the direction of the signal flow, around the loop back to the starting point. Remember that transistors cannot have an input signal applied to the drain (collector) and an output signal taken from the gate (base).

b.) The feedback is negative (positive) if the gain around the loop (either voltage or current gain) is negative (positive). Be sure to set the input to zero in this test.

c.) The identity of the mixing network can be found by implementing the feedback summing equation, $v_i = v_s - v_f$ or $i_i = i_s - i_f$. If the input source, x_s, has one of its terminals on ground, then the mixing network must be current (shunt) if the input transistor has one of its two possible input terminals on ground.

d.) The identity of the sampling network can be found by placing a test resistance, R_t across the output of the feedback amplifier is one does not already exist. This resistance should be at the point where v_o and i_o are defined. If the x_f variable goes to zero when R_t is zero, then the sampling network is voltage (shunt). If the x_f variable goes to zero when R_t is infinite, the sampling network is current (series). If the resistance, R_t, has one of its terminals on ground, then sampling network must be voltage (shunt) if the output transistor has one of its two possible output terminals on ground.

2.) Open the feedback loop.

a.) Identify in the circuit the loop or node that is associated with the mixing or sampling network. (If the mixing or sampling network is series, a loop or mesh exists in which a current flows. If the mixing or sampling network is shunt, a node exists across which a voltage occurs.)

b.) Identify the feedback part of the network. (In step 1a), the path from the input to the output of the amplifier will normally be associated with the A network while the path from the output back to the input will normally be associated with the ß network.)

c.) Break the feedback network and replace it with a resistance to ground ($R_{ßin}=R_1$) seen from the input looking into the ß network and a resistance to ground ($R_{ßout} = R_2$) seen from the output looking into the ß network. $R_{ßin}$ and $R_{ßout}$ are calculated as follows: