Miller's Theorem

- The introduction of an impedance that connects amplifier input and output ports adds a great deal of complexity in the analysis process. One technique that often helps reduce the complexity in some circuits is the use of Miller's theorem.

- Miller's theorem applies to the process of creating equivalent circuits. This general circuit theorem is particularly useful in the high-frequency analysis of certain transistor amplifiers at high frequencies.

Miller's Theorem generally states:

Given any general linear network having a common terminal and two terminals whose voltage ratio, with respect to the common terminal, is given by:

\[ V_2 = A V_1. \]  

If the two terminals of the network are then interconnected by an impedance, \( Z \), an equivalent circuit can be formed. This equivalent circuit consists of the same general linear network and two impedances; each of which shunt a network terminal to common terminal. These two impedances have value (Figure 10.5-1):

\[ Z_1 = \frac{Z}{1 - A} \quad Z_2 = \frac{AZ}{A - 1} \]  

Figure 10.5-1 Miller Equivalent Circuits

a) Interconnecting Impedance

b) Port-Shunting Impedances