miller_1.sqproj

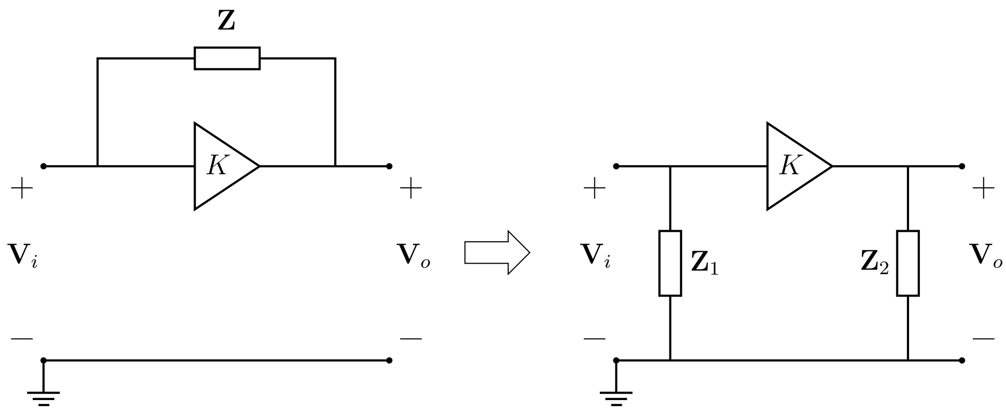

Figure 1: (a) Original circuit, (b) Equivalent circuit after application of Miller's theorem.

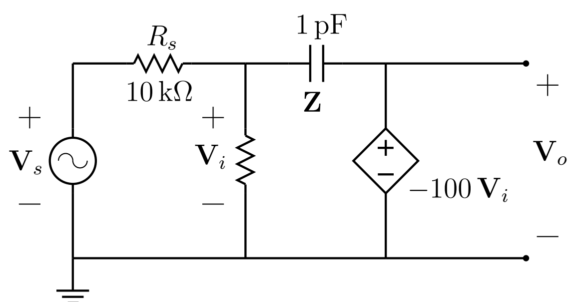

Figure 2: Example for application of Miller's theorem.

Miller's theorem can be used to simplify the small-signal equivalent circuit of an amplifier when an impedance appears between the input and output nodes. Fig. 1 (a) shows an amplifier with gain K, and an impedance $\mathbf{Z}$ connected between the input and output nodes. Using Miller's theorem, $\mathbf{Z}$ can be replaced with $\mathbf{Z}_1$ and $\mathbf{Z}_2$ as shown in Fig. 1 (b), where

$$\mathbf{Z}_1 = \frac{\mathbf{Z}}{1-K}\,, \quad \mathbf{Z}_2 = \frac{\mathbf{Z}}{1-(1/K)}\,. \tag{1}$$

In this exercise, we want to analyse the circuit shown in Fig. 2 using Miller's theorem. We will treat R_i to be infinite for simplicity.

Exercise Set

1. Find $\mathbf{Z}_1(s)$ and $\mathbf{Z}_2(s)$ for the circuit shown in Fig. 2.

2. Replace $\mathbf{Z}$ with $\mathbf{Z}_1$ and $\mathbf{Z}_2$, and obtain the transfer function $H(s) = V_o(s)/V_s(s)$.

3. Plot $H(j\omega)$ versus frequency (Bode plot).

4. Verify your results with simulation.

References

1. A. S. Sedra, K. C. Smith, and A. N. Chandorkar, *Microelectronic Circuits: Theory and Applications*, Fifth edition, Oxford University Press, 2009.