电子电路手册

Electronic Circuits Manual

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序言

Preface

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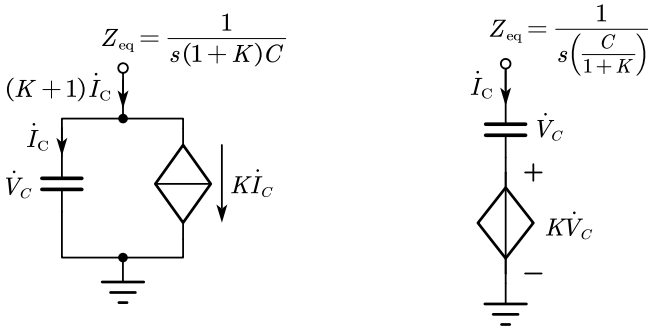
Chapter 1 Capacitance

1.1 Capacitance Multiplier

This part refers to references [**?**] and [**?**]. Below are two basic concepts for capacitance multiplication:



(a) Current Mode (b) Voltage Mode

Figure 1.1: Basic Capacitance Multiplier Circuits

Thus, we obtain the equivalent capacitance as:

$$\text{Current Mode: } C_{\text{eq}}=(1+K)C \Longrightarrow \begin{cases} C_{\text{eq}}>C, & K>0 \\ C_{\text{eq}}<C, & K<0 \end{cases} \tag{1.1}$$

$$\text{Voltage Mode: } C_{\text{eq}}=\frac{C}{1+K} \Longrightarrow \begin{cases} C_{\text{eq}}<C, & K>0 \\ C_{\text{eq}}>C, & K<0 \end{cases} \tag{1.2}$$

A simple implementation of cap multiplier, depicted in Fig.1.2, combining a unit-gain buffer (voltage fllower) and a inverting amplifier, is a voltage mode circuit. yielding the equivalent capacitance:

$$C_{\text{eq}}=\frac{C}{1+K}=\frac{1}{1-\frac{R_2}{R_1}}=\frac{R_1}{R_1-R_2}C \tag{1.3}$$

where $K=-\frac{R_2}{R_1}$ is the closed-loop gain of the inverting amplifier. Since inverting amplifier has a low input impedance, the unit-gain buffer is a necessary. To change it into a two-terminal element, just replace GND with the negtive terminal of the input voltage, e.g. $V_{\text{in},-}$.

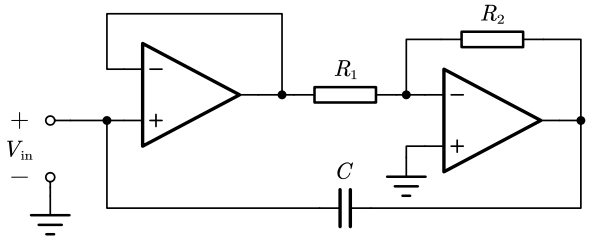


Figure 1.2: A Simple Implementation of Capacitance Multiplier

1.2 Capacitance Measurement

1.3 Varible Capacitance