1 Abstract

2 Introduction

3 Voltage dividers

We use two 10 kΩ resistors to form a resistive voltage divider. When applying a DC current, we measure $V_{\text{in}} = 6.13$ V and $V_{\text{out}} = 3.05$ V. Current is 0.30 mA. Strangely, when we apply a 1 MHz signal with $V_{\text{pp}} = 5$ V, we find extreme signal attenuation. This also occurs at 1 kHz. When we change our resistors to 1.2 kΩ, we observe a signal scaled by 1/2 as expected. We do not currently understand why 10 kΩ resistors cause such a decreased gain.

We use two 10 nF capacitors to form a capacitive voltage divider. The capacitors halve sinusoidal input signals at both 1 kHz and 1 MHz as expected. If we add a resistor to ground at the output, we expect:

$$\frac{V_{out}}{V_{in}} = \frac{1}{2 + 1/(j\omega RC)} \tag{1}$$

where j is the imaginary unit, ω is signal angular frequency (rad/s), and R and C are resistor and capacitor values (Ω, F). In effect, the circuit now behaves as a high-pass filter.

4 RC, LC, and RLC filters

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5 Diodes

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6 FM demodulator

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