Homework for Chapter 6

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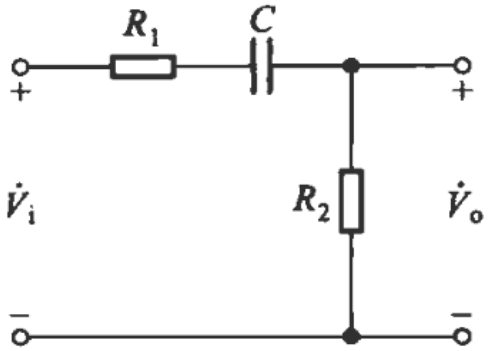
6.2.1 电路如图题 6.2.1 所示，设其中 $R_1 = 1\text{k}\Omega$，$R_2 = 10\text{k}\Omega$，$C = 1\mu\text{F}$。试求该电路：(1) 是高通还是低通电路？(2) 电压增益的表达式及它的最大值；(3) 转折频率的大小。



图题 6.2.1

The circuit is a High-pass filter, since the impedance of capacitor is represented as

$$R_C = \frac{1}{sC} \qquad s = j\omega$$

The gain of this circuit is represented as

$$\frac{V_o}{V_i}$$

Whereas

$$V_o = \frac{R_2}{R_1 + \dfrac{1}{sC} + R_2} V_i = \frac{R_2}{R_1 + R_2} \frac{s}{s + \dfrac{1}{C\left(R_1 + R_2\right)}}$$

So that the corner frequency is

$$f_0 = \frac{1}{2\pi C\left(R_1 + R_2\right)} \approx 14.5 \text{ Hz}$$

The gain of the circuit is

$$\frac{V_o}{V_i} = \frac{R_2}{R_2 + R_1} \frac{s}{s + \omega_0} \qquad \omega_0 = \frac{1}{C\left(R_1 + R_2\right)}$$

The maximum gain is

$$\left.\frac{V_o}{V_i}\right|_{max} = \frac{R_2}{R_2 + R_1} \approx 0.909$$