Op-amp circuits (EC_opamp_3.sqproj)

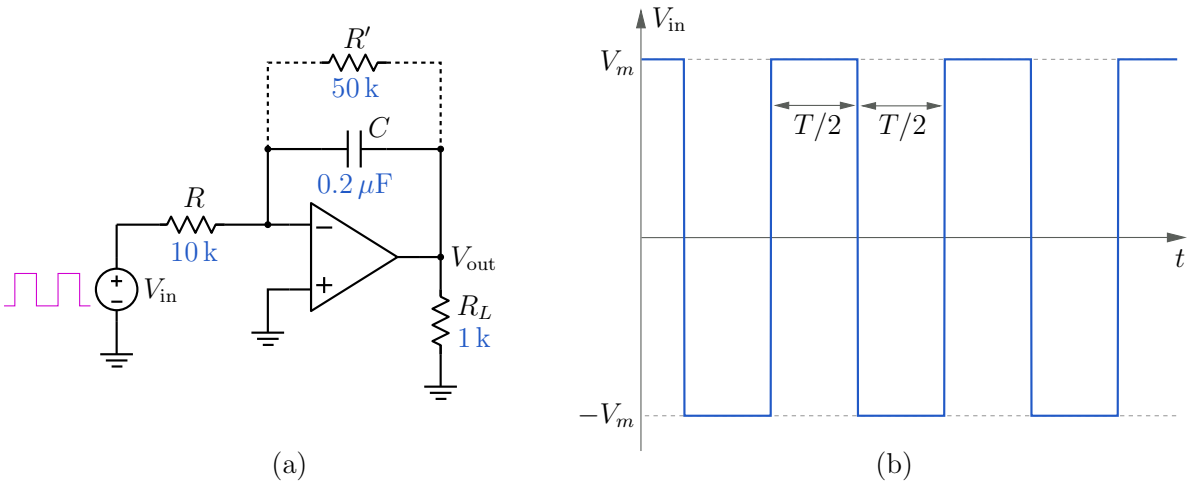

Figure 1: (a) Op-amp integrator circuit, (b) Input voltage waveform.

Question: In the integrator circuit shown in Fig. 1, the input voltage has $V_m = 5\,\text{V}$ and a frequency of 500 Hz. Plot the output waveform.

(Note that the resistor R' is required in a practical integrator circuit to prevent the op-amp from going into saturation because of op-amp offset voltage or input bias current.)

Solution:

The output voltage waveform for a square wave input is shown in Fig. 2. When V_{in} is equal to

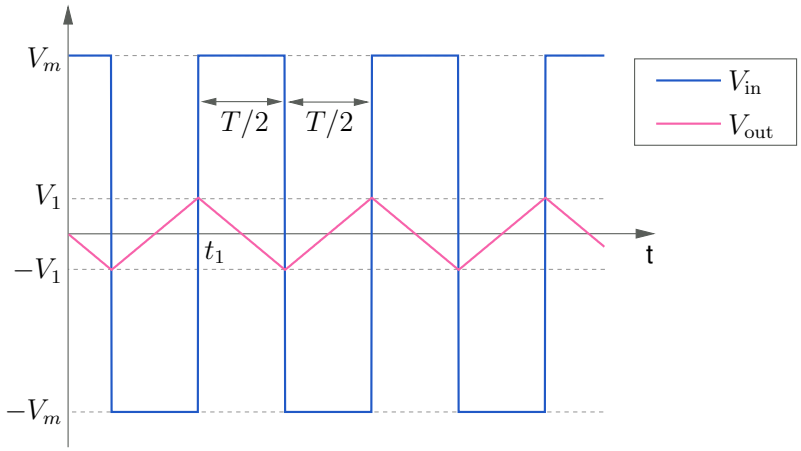

Figure 2: Input and output waveforms for the integrator of Fig. 1.

$+V_m$, we have

$$V_{\text{out}} = -\frac{1}{RC}\int V_{\text{in}}dt = -\frac{1}{RC}\int V_m dt\,. \tag{1}$$

Integrating from t_1 to $t_1 + T/2$ (see Fig. 2), we get

$$-V_1 - V_1 = -\frac{1}{RC} V_m \frac{T}{2} \;\rightarrow\; 2\,V_1 = V_m \frac{T}{2\,RC}\,. \tag{2}$$

For the R, C, V_m, T values specified above, we get $V_1 = 1.25\,\mathrm{V}$.

SequelApp Exercises: With $C = 0.1\,\mu\mathrm{F}$ and the same input voltage as specified above, what value of R will produce a 6 V peak-to-peak output voltage? Verify your answer using SequelApp.