ELECENG 2CJ4 Lab 4

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a) The measured values for V_{sat+} and V_{sat-} are $V_{sat+} = 7.1378$ and $V_{sat-} = -7.13792$. The calculated values for V_{th+} and V_{th-} are $V_{th+} = \frac{R_2}{R_1+R_2}V_{sat+} = 7.1378\left(\frac{10k}{35k}\right) = 2.039V$ and $V_{th-} = \frac{R_2}{R_1+R_2}V_{sat-} = -7.13792\left(\frac{10k}{35k}\right) = -2.039V$.

b) The waveforms for $v_c(t)$ and $v_{out}(t)$ for $C = 10nF, R_3 = 100k\Omega$ can be seen in Figure 1. The period was measured to be approximately $500\mu s$ (2 kHz). The theoretical period was calculated to be $T = RC\left(\ln\frac{V_{sat+}-V_{th-}}{V_{sat+}-V_{th+}} + \ln\frac{V_{sat-}-V_{th+}}{V_{sat-}-V_{th-}}\right) = 0.001175 \approx 1175\mu s$ (851 Hz). The calculated theoretical value was over double the measured period.
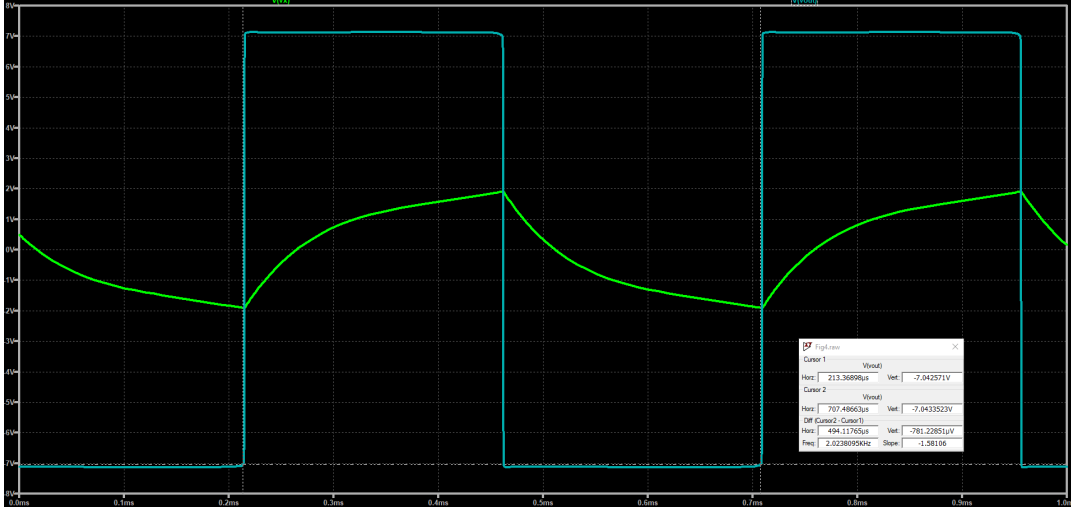

Figure 1: $v_c(t)$ (green) and $v_{out}(t)$ (cyan) for $C = 10nF, R_3 = 100k\Omega$

c) The waveforms for $v_c(t)$ and $v_{out}(t)$ for $C = 10nF, R_3 = 10k\Omega$ can be seen in Figure 2. The period was measured to be approximately $94\mu s$ (10.7 kHz).
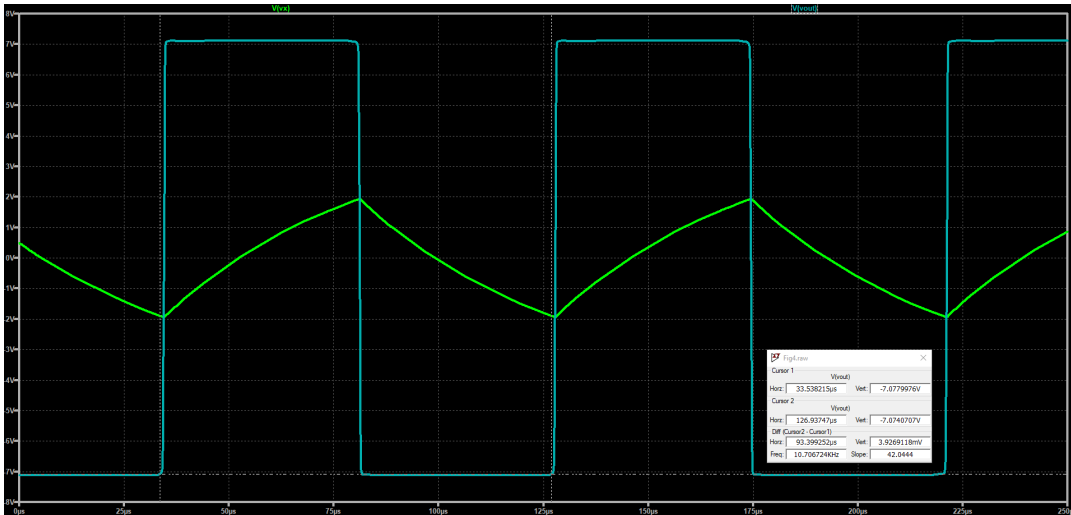

Figure 2: $v_c(t)$ (green) and $v_{out}(t)$ (cyan) for $C = 10nF, R_3 = 10k\Omega$

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The waveforms for $v_c(t)$ and $v_{out}(t)$ for $C = 100nF$, $R_3 = 100k\Omega$ can be seen in Figure 3. The period was measured to be approximately 5ms (200 Hz).
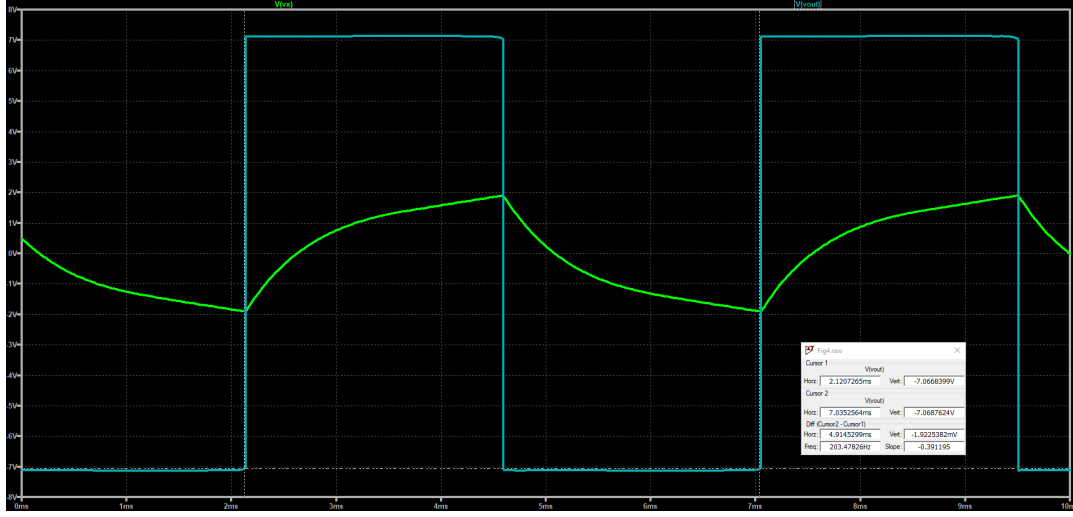

Figure 3: $v_c(t)$ (green) and $v_{out}(t)$ (cyan) for $C = 100nF$, $R_3 = 100k\Omega$

The waveforms for $v_c(t)$ and $v_{out}(t)$ for $C = 100nF$, $R_3 = 10k\Omega$ can be seen in Figure 4. The period was measured to be approximately 915μs (1.09 kHz).
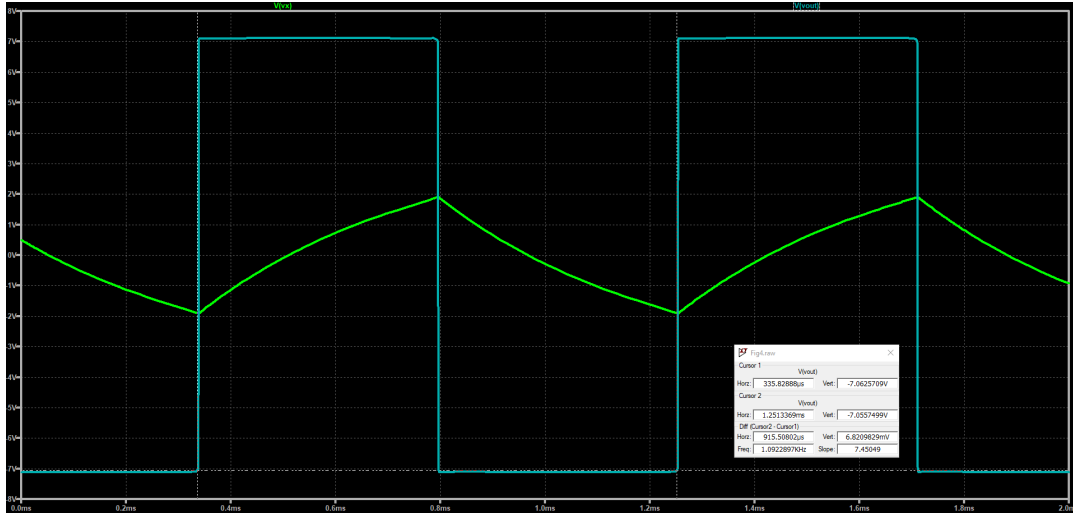

Figure 4: $v_c(t)$ (green) and $v_{out}(t)$ (cyan) for $C = 100nF$, $R_3 = 10k\Omega$

d) The waveforms for $v_c(t)$ and $v_{out}(t)$ can be seen in Figure 5. The period was measured to be approximately $310\mu s$ (3.22 KHz).
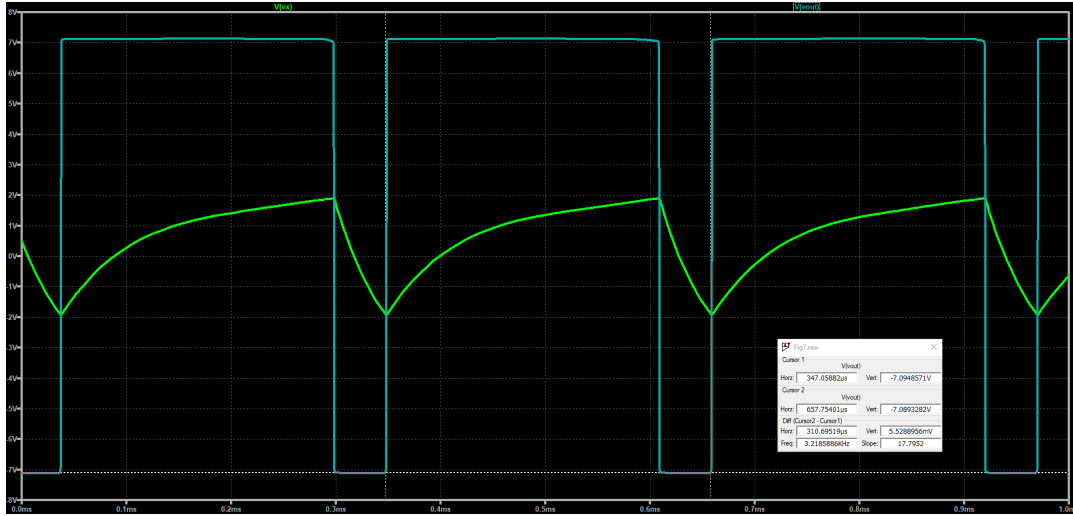

Figure 5: $v_c(t)$ (green) and $v_{out}(t)$ (cyan)