VE311 HW2 周貌然 5180219111039

1.(a) If $T-\Delta T \ll RC$ and $\Delta T \ll T$

$$V_r \approx (V_S - V_{on})\left(\frac{T}{RC}\right) = (6-0.7)\left(\frac{1}{60}\cdot\frac{1}{1000\cdot C}\right) < 0.1 \Rightarrow C > 8.83\times10^{-4}\ F$$

$$V_{dc} = V_S - V_{on} = 6 - 0.7 = 5.3\ V$$

$$I_{dc} = \frac{V_{dc}}{R} = \frac{5.3}{1000} = 5.3\times10^{-3}\ A$$

$$\theta_c = \sqrt{\frac{2V_r}{V_S}} = \sqrt{\frac{2\times0.1}{6}} = 0.1826\ rad$$

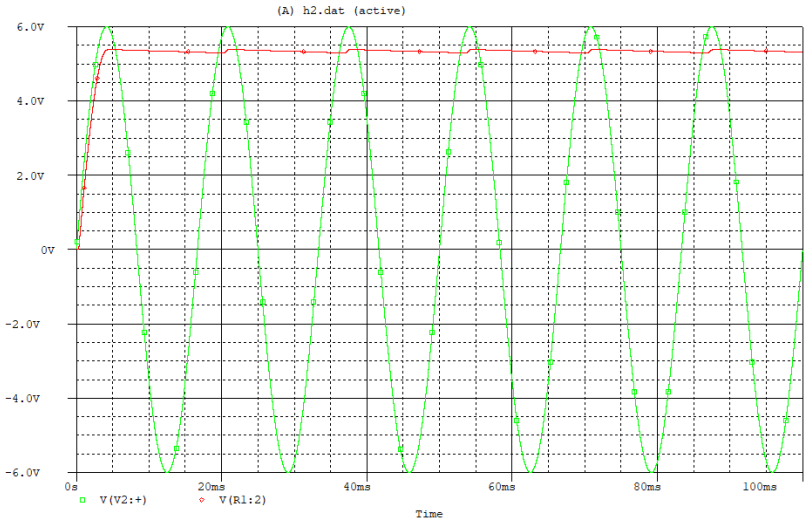
$$\Delta T = \frac{\theta_c}{\omega} = 4.84\times10^{-4}\ s$$

$$I_{peak} = \frac{2I_{dc}T}{\Delta T} = 0.3648\ A$$

$$I_{surge} = \omega C V_S = 1.998\ A$$

$$PIV = 2V_S - V_{on} = 11.3\ V$$

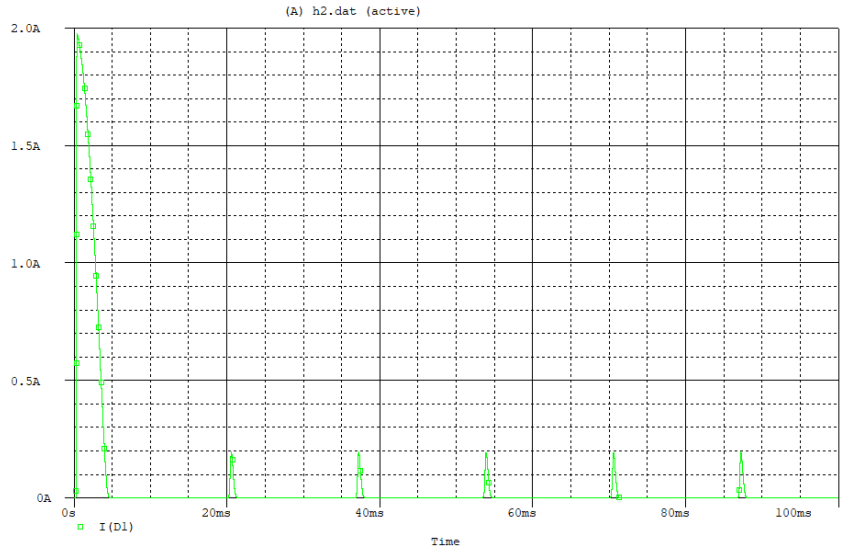
(b).




From the graph, we know $V_{dc} = 5.39\ V$, $I_{dc} = 5.39\times10^{-3}\ A$, $V_r = 0.1\ V$, $PIV = 11.34\ V$

Generally, they are very close to the hand-calculated results. The difference may be because of the precision of reading. It may also because that part of the circuit is not ideal.

(C).




From the graph, we know $I_{peak} = 0.193V$, $I_{surge} = 1.97\ V$.
The $I_{surge}$ is close to the hand-calculated value, while the $I_{peak}$ is about half of the hand-calculated one.

2.(a). If $\left(\frac{T}{2}-\Delta T\right) \ll RC$ and $\Delta T \ll \frac{T}{2}$

$V_r \approx (V_s - 2V_{on})\left(\frac{T}{2RC}\right) = (6-2\times 0.7)\left(\frac{1}{60}\times\frac{1}{2\times 1000C}\right) < 0.1 \Rightarrow C > 3.83\times 10^{-4}\ F$

$V_{dc} = V_s - 2V_{on} = 4.6\ V$

$I_{dc} = \frac{V_{dc}}{R} = 4.6\times 10^{-3}\ A$

$\theta_c = \sqrt{\frac{2V_r}{V_s}} = 0.1826\ rad$

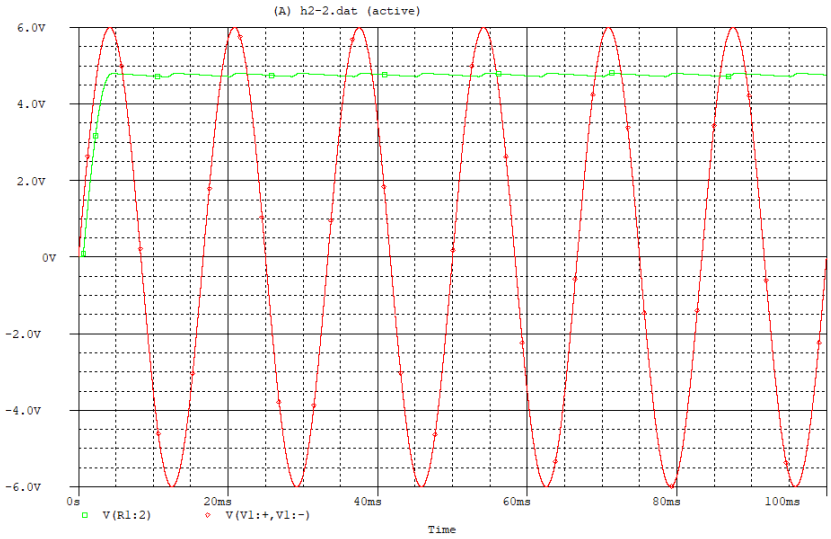
$\Delta T = \frac{\theta_c}{\omega} = 4.84\times 10^{-4}\ s$

$I_{peak} = \frac{I_{dc}\,T}{\Delta T} = 0.1583\ A$

$I_{surge} = \omega C V_s = 0.8671\ A$

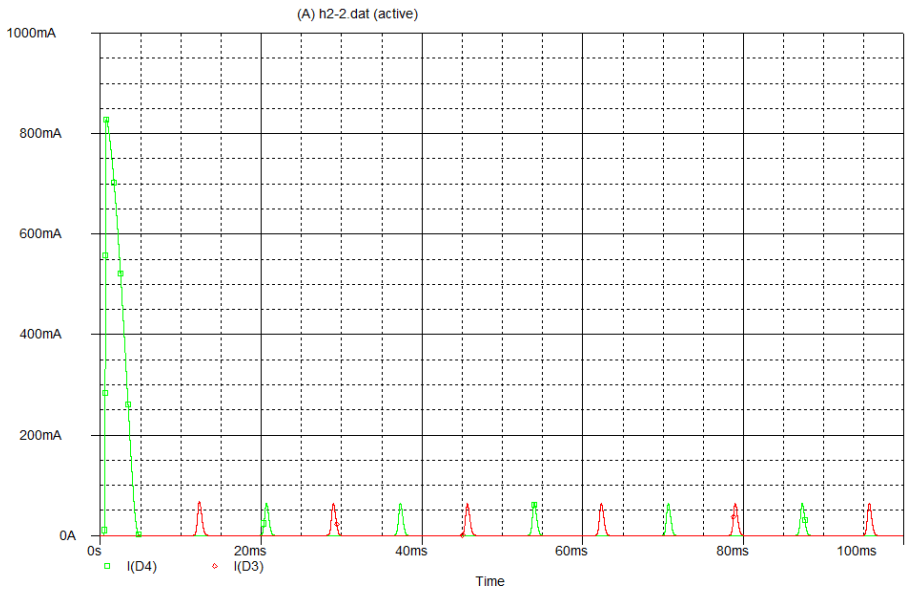
$PIV = V_s - V_{on} \approx 5.3\ V$

(b).




From the graph, we can know $V_{dc}=4.81\ V$, $I_{dc}=4.81\times 10^{-3}A$, $V_r=0.1\ V$, $PIV=5.41\ V$
Generally, they are very close to the hand-calculated value. The small difference may be because of the precision of reading. It may also because that part of the circuit is not ideal.

(C).




From the graph, we can know $I_{peak} = 0.0631\ A$, $I_{surge} = 0.832A$

The $I_{surge}$ is close to the hand-calculated value, while the $I_{peak}$ is about half of the hand-calculated one.