Homework 2

VE311 - Electronic Circuits Fall 2021

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2.1

(a) The ripple voltage

$$V_r = (V_S - V_{on})\frac{T}{RC} < 0.1$$

We replace the constants

$$V_S = 5\text{V}, V_{on} = 0.9\text{V}, T = 0.01, R = 100$$

Solving the equation, we get

$$C > 4.1 \times 10^{-3} F$$

$C = 4.1 \times 10^{-3} F$, we have

$$V_{dc} = V_s - V_{on} = 4.1 \text{ V}$$
$$I_{dc} = \frac{V_{dc}}{R} = 0.041 \text{ A}$$
$$\theta_c = \sqrt{\frac{2V_r}{V_s}} = 0.2$$
$$\Delta T = \frac{\theta_c}{\omega} = 3.18 \times 10^{-4} \text{ s}$$
$$I_{\text{peak}} = \frac{2I_{dc}T}{\Delta T} = 2.576 \text{ A}$$
$$I_{\text{surge}} = \omega C V_s = 12.88 \text{ A}$$
$$PIV = 2V_s - V_{on} = 9.1 \text{ V}$$

(b) The plot is attached here.

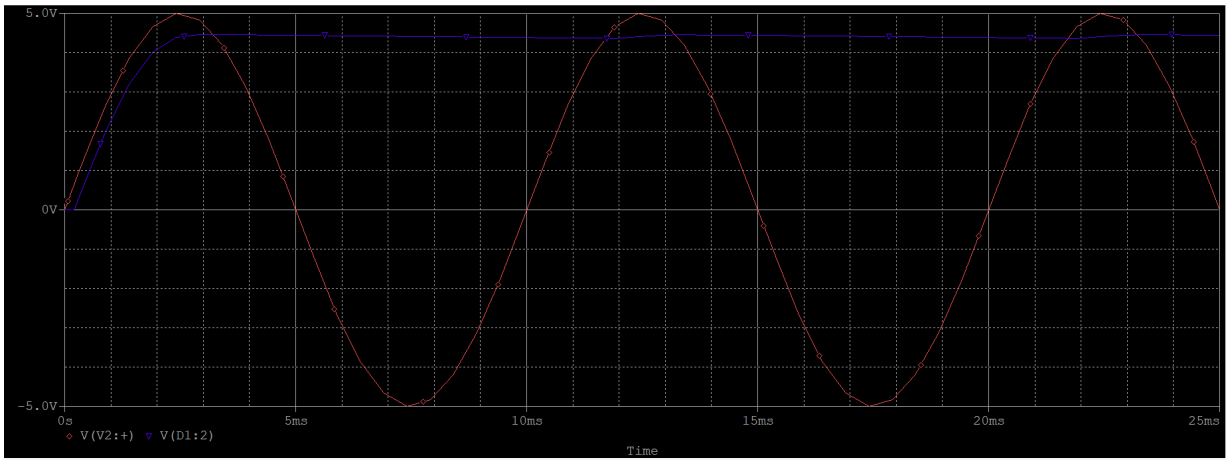

Figure 1: problem b

$$V_{dc} = 4.2 \text{ V}$$
$$I_{dc} = \frac{V_{dc}}{R} = 0.042A$$
$$V_r = 0.1 \text{ V}$$
$$PIV = 9.2 \text{ V}$$

The results are consistent with calculated equations.

(c) The plot is attached here.

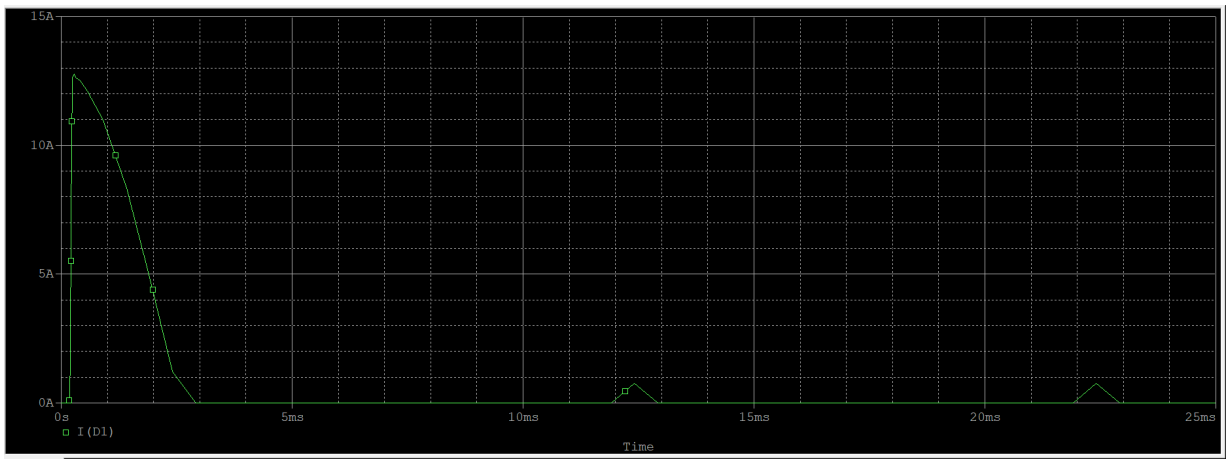

Figure 2: problem c

$$I_{\text{peak}} = 0.8 \text{ A}$$
$$I_{\text{surge}} = 12.8 \text{ A}$$

The simulation result of I_{surge} is consistent with calculating equations; the simulation result of I_{peak} is not the same as calculating equations, maybe because ΔT is not the same.

2.2

(a) The ripple voltage is

$$V_r = (V_s - 2V_{on}) \frac{T}{2RC} < 0.1$$

We replace the constants

$$V_S = 5\text{V}, V_{on} = 0.9\text{V}, T = 0.01, R = 100$$

Solving the equation, we get

$$C > 1.60 \times 10^{-3} F$$

$$V_{dc} = V_s - 2V_{on} = 3.2 \text{ V}$$
$$I_{dc} = \frac{V_{dc}}{R} = 0.032 \text{ A}$$
$$\theta_c = \sqrt{\frac{2V_r}{V_s}} = 0.2$$
$$\Delta T = \frac{\theta_c}{\omega} = 3.18 \times 10^{-4} \text{ s}$$
$$I_{\text{peak}} = \frac{I_{dc} T}{\Delta T} = 1.005 \text{ A}$$
$$I_{\text{surge}} = \omega C V_s = 5.027 \text{ A}$$
$$PIV = V_s - V_{on} = 4.1 \text{ V}$$

(b) The plot is attached here.

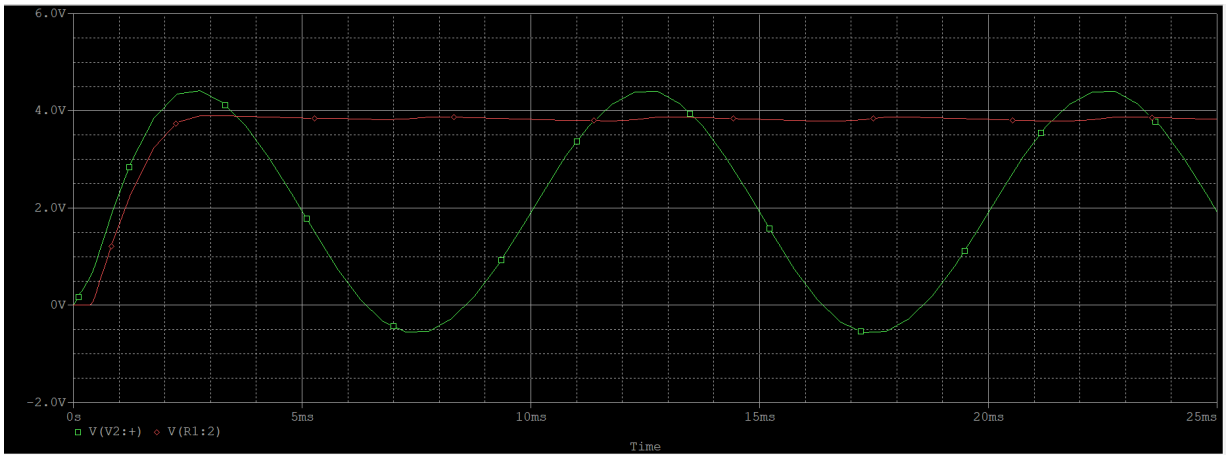

Figure 3: problem b

$$V_{dc} = 3.7 \text{ V}$$
$$I_{dc} = \frac{V_{dc}}{R} = 0.037 \text{ A}$$
$$V_r = 0.1 \text{ V}$$
$$PIV = 4.1 \text{ V}$$

The results are consistent with calculated equations.

(c) The plot is attached here.

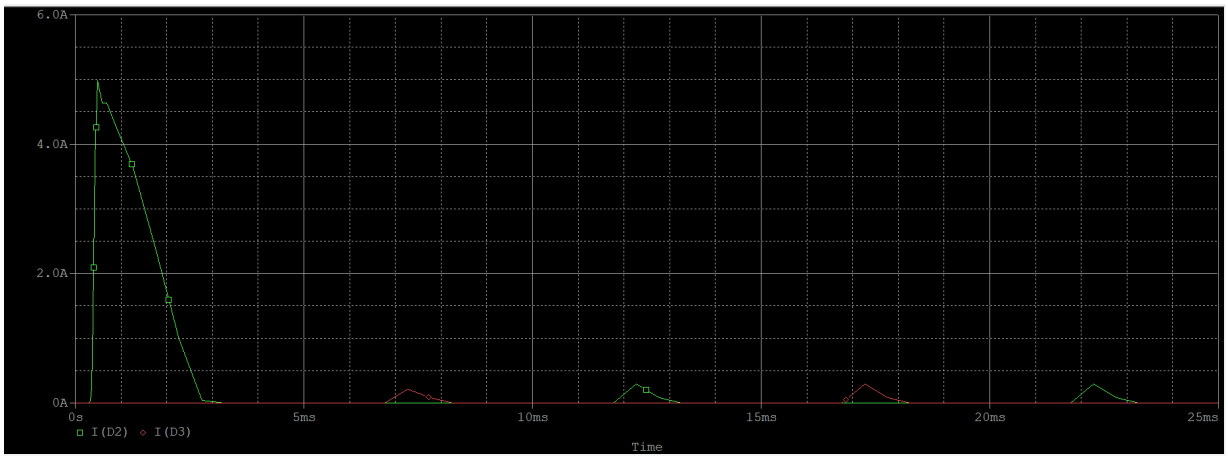

Figure 4: problem b

$$I_{\text{peak}} = 0.7 \text{ A}$$
$$I_{\text{surge}} = 5.0 \text{ A}$$

The simulation result of I_{surge} is consistent with calculating equations; the simulation result of I_{peak} is not the same as calculating equations, maybe because ΔT is not the same.