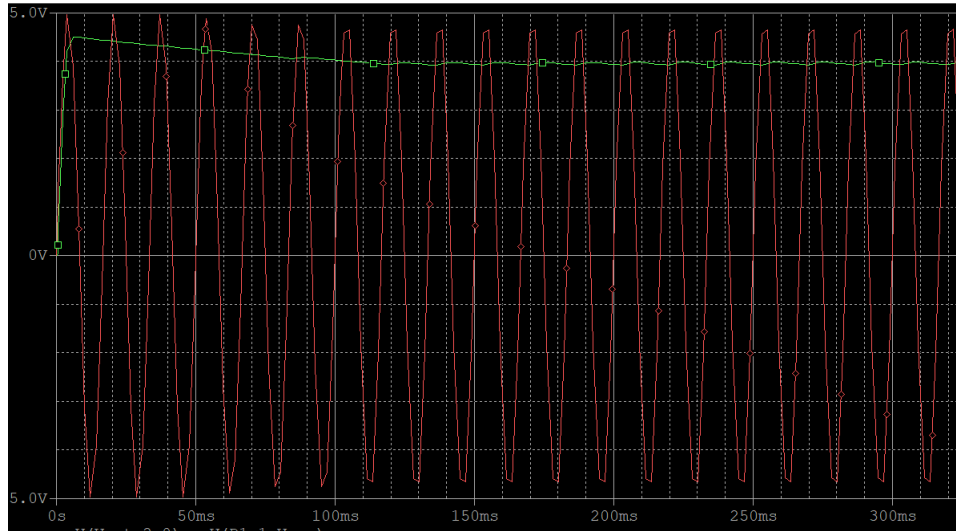


1 Problem1

1.1 (a)

$$\begin{aligned}V_{dc} &= V_s - V_{on} = 5 - 0.7 = 4.3(V) \\I_{dc} &= \frac{V_{dc}}{R} = \frac{4.3}{5000} = 0.86(mA) \\V_r &\approx V_{dc} \frac{T}{RC} = 4.3 \frac{1}{60 * 5000C} = 0.1 \rightarrow C \approx 143(\mu F) \\\theta_c &\approx \sqrt{\frac{2V_r}{V_s}} = \sqrt{\frac{2 * 0.1}{5}} = 0.2(rad) \\\Delta T &\approx \frac{\theta_c}{\omega} = \frac{0.2}{2\pi * 60} = 5.3 \times 10^{-4}(s) \\I_{surge} &= \omega CV_s = 2\pi * 60 * 143 \times 10^{-6} * 5 = 0.27(A) \\I_{peak} &= \frac{2I_{dc}T}{\Delta T} = \frac{2 * 0.86 \times 10^{-3}}{60 * 5.3 \times 10^{-4}} = 0.054(A) \\PIV &= 2V_s - V_{on} = 10 - 0.7 = 9.3(V)\end{aligned}$$

1.2 (b)



I can't set the V_{on} for the diode in pspice, but from the graph $V_{dc} = 4(V)$, $I_{dc} = 0.8(mA)$, $V_r = 0.6(V)$ and $PIV = 9(V)$. By comparing the simulation result with my calculation result, I find that all simulation results are slightly smaller than the calculation results, but there is not much big difference. I think it's due to the fact that the diode in pspice has a higher $V_{out} = 1(V)$ so that V_{dc} , V_r , I_{dc} and PIV are smaller.

1.3 (c)



From the simulation and graphs, $I_{surge} \approx 0.26(A)$, and $I_{peak} \approx 26(mA)$ and I_{surge} is very close to my calculation result but I_{peak} is much smaller, I think this difference is caused by my reading error.

2 Problem2

2.1 (a)

$$V_{dc} = V_s - 2V_{on} = 5 - 2 * 0.7 = 3.6(V)$$

$$I_{dc} = \frac{V_{dc}}{R_{dc}} = \frac{3.6}{5000} = 0.72(mA)$$

$$V_r \approx V_{dc} \frac{T}{RC} = 3.6 \frac{1}{2 * 60 * 5000C} = 0.1 \rightarrow C \approx 60(\mu F)$$

$$\theta_c \approx \sqrt{\frac{2V_r}{V_s}} = \sqrt{\frac{2 * 0.1}{5}} = 0.2(rad)$$

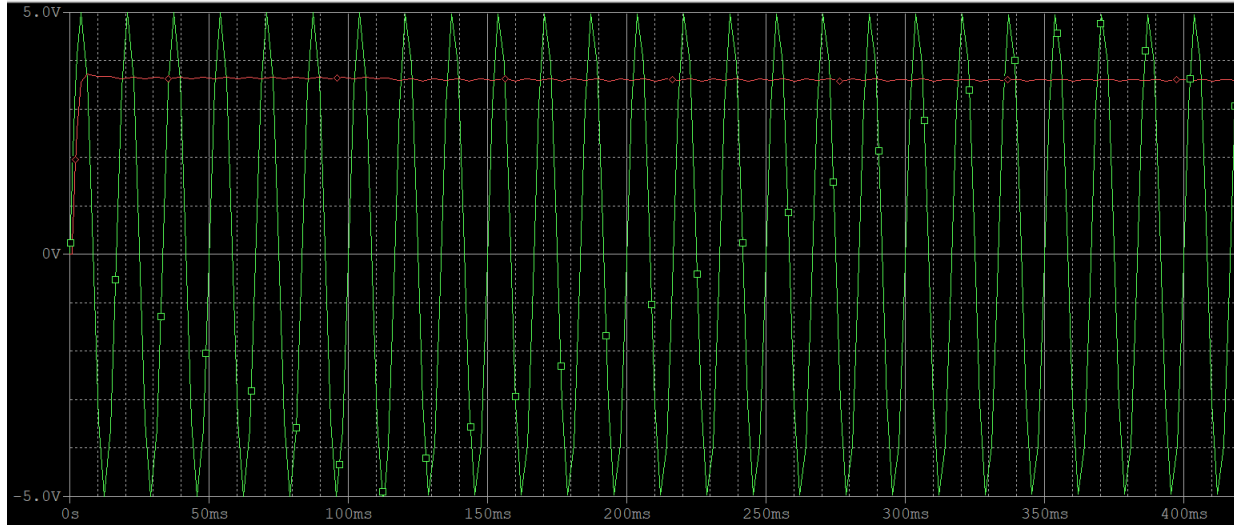
$$\Delta T \approx \frac{\theta_c}{\omega} = \frac{0.2}{2\pi * 60} = 5.3 \times 10^{-4}(s)$$

$$I_{surge} = \omega C V_s = 2\pi * 60 * 60 \times 10^{-6} * 5 = 0.113(A)$$

$$I_{peak} = \frac{I_{dc} T}{\Delta T} = \frac{8.6 \times 10^{-4}}{60 * 5.3 \times 10^{-4}} = 0.0225(A)$$

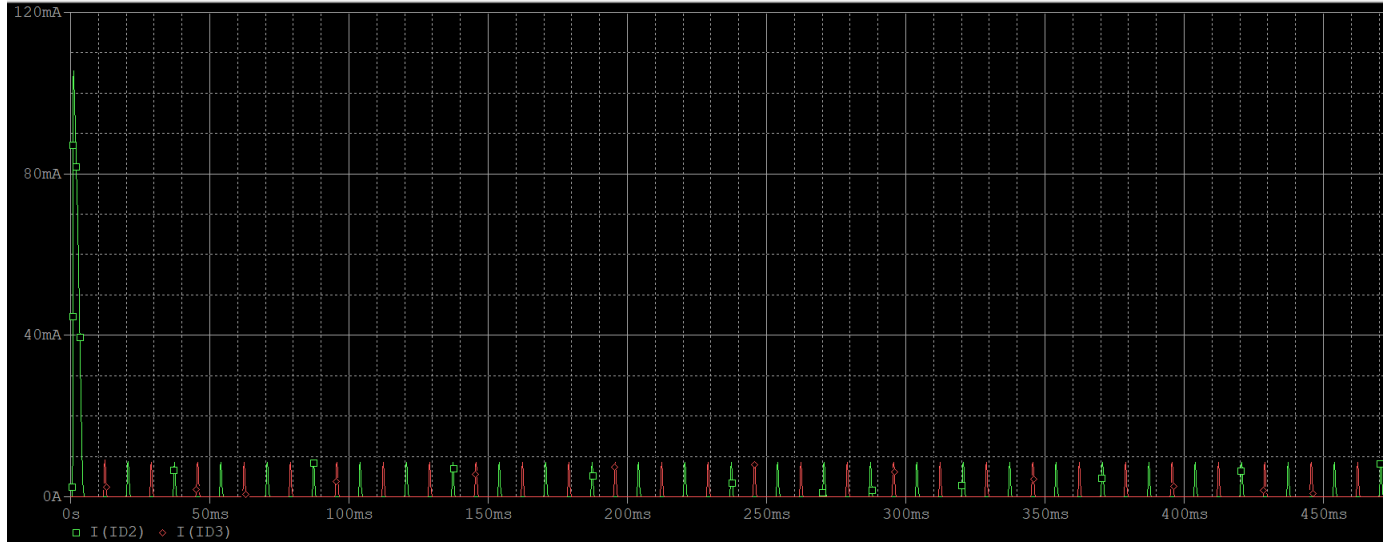
$$PIV = V_s - V_{on} = 5 - 0.7 = 4.3(V)$$

2.2 (b)



I can't set the V_{on} for the diode in pspice, but from the graph $V_{dc} = 3.6(V)$, $I_{dc} = 0.72(mA)$, $V_r = 0.02(V)$ and $PIV = 4(V)$. By comparing the simulation result with my calculation result, I find that all simulation results are slightly closer to the calculation results than half-wave rectifier, I think it's because there are more diodes so that the difference of V_{out} is reduced

2.3 (c)



From the simulation and graphs, $I_{surge} \approx 0.212(A)$, and $I_{peak} \approx 10(mA)$, I_{surge} is very close to my calculation result, but I_{peak} is much smaller from calculation results. In addition, only one of these two currents has I_{surge} while their currents both have I_{peak} and they have the same value. When one of these currents is 0, the other is at I_{peak}