UNIVERSITAS
GADJAH MADA

Final Projects Exam - Power Electronics

Rizki Alfiansyah

(21/478438/TK/52722)

LOCALLY ROOTED,

GLOBALLY RESPECTED

ugm.ac.id

UNIVERSITAS
GADJAH MADA

Buck Converter

Design a buck converter to step down voltage with detail instructions.

Specification Buck Converter

- Input Voltage : 24 Volt
- Output voltage : 9 V
- Switching Frequency : 100 kHz
- Output Power : 8.1 Watt
- Current Ripple : 0.05 A
- Voltage Ripple : 0.5 V

Determine L Value

$$L = \frac{(V_{in} - V_{out}).D}{\Delta I_L . f_s}$$

$$L = \frac{(24 - 9).0.375}{0.5\ .100000}$$

$$L = \frac{5.625}{50000}$$

$$\boldsymbol{L = 1.125 \times 10^{-3}}$$

$V_{in} = Tegangan\ \ Input$

$V_{out} = Tegangan\ \ Output$

$D = Duty\ \ Cycle$

$\Delta I_L = Ripple\ \ Arus$

$f_s = Frekuensi\ \ Switching$

Determine C Value

$$C = \frac{\Delta I_L}{8.f_s.\Delta V_{OUT}}$$

$$C = \frac{0.5}{8.100000.0.5}$$

$$C = 1.25 \times 10^{-6}$$

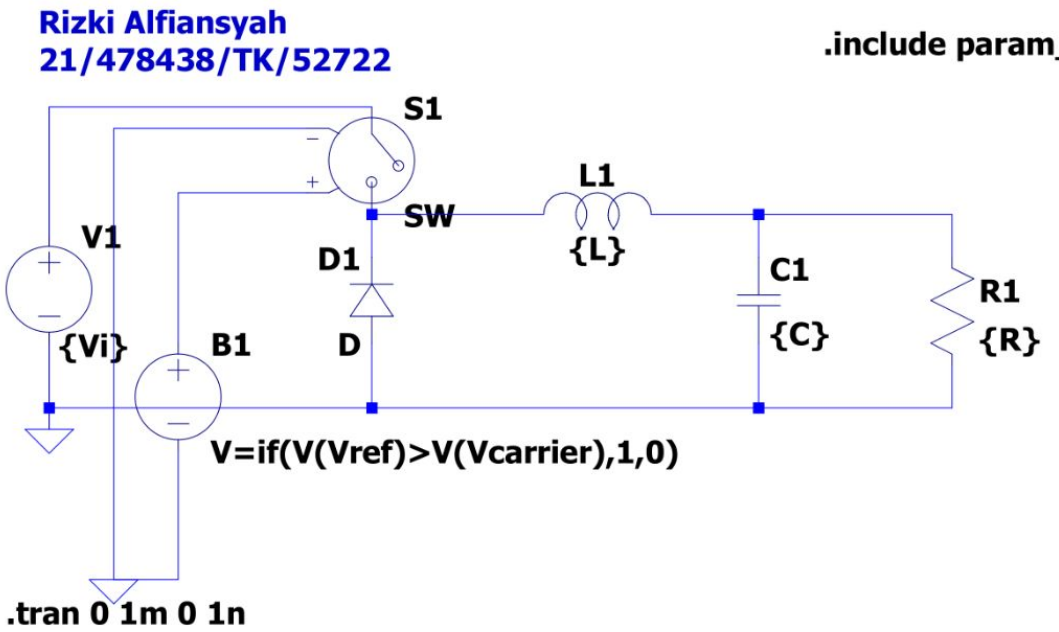
$C = Nilai\ Kapasitor$

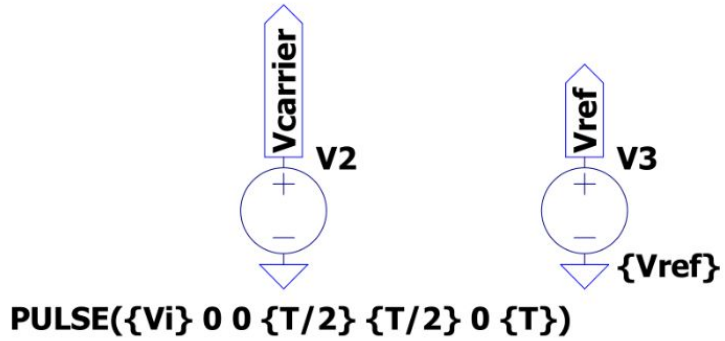
$\Delta I_L = Ripple\ Arus$

$f_s = Frekuensi\ Switching$

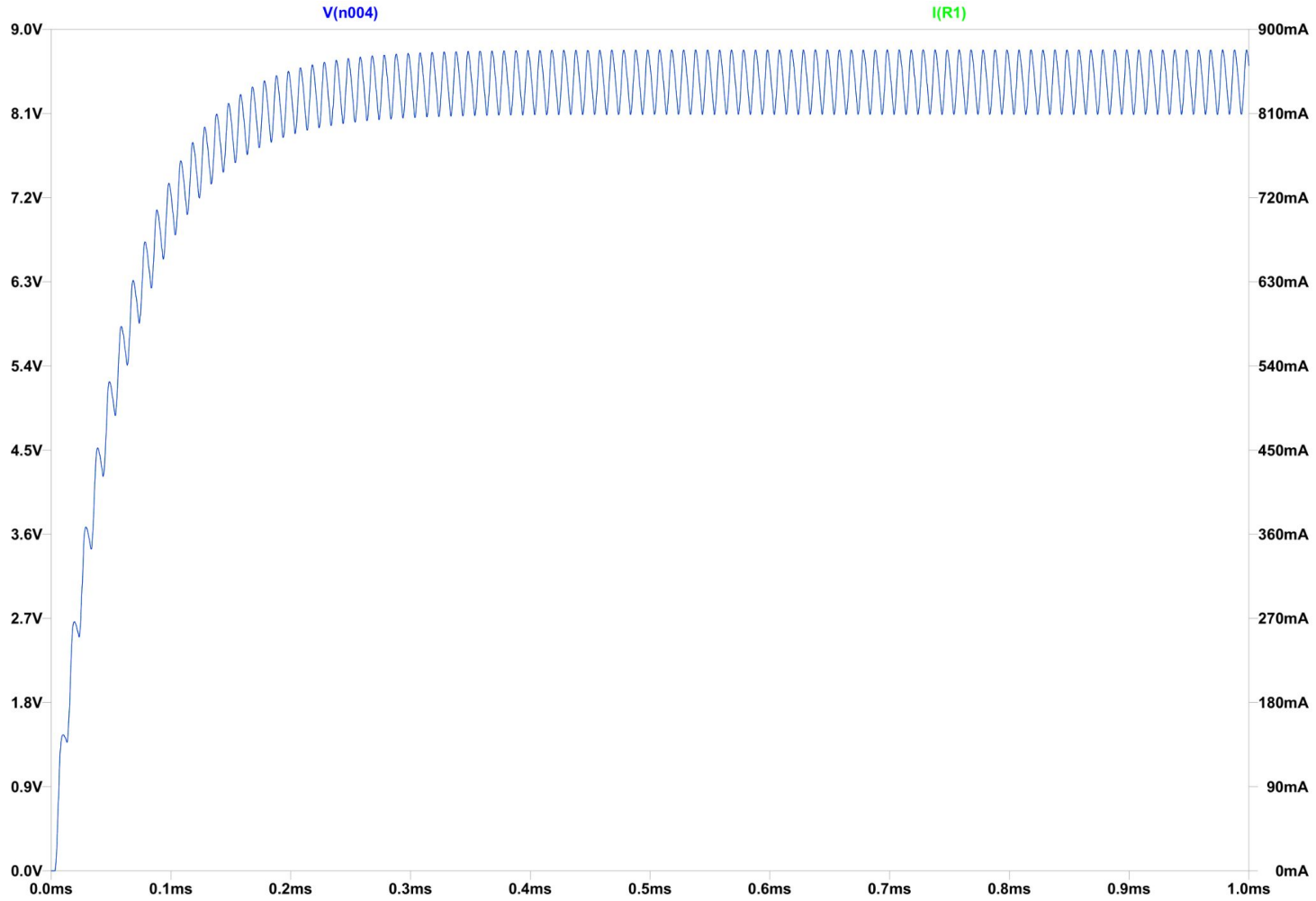
$\Delta V_{out} = Ripple\ Tegangan$

Open-Loop Buck Converter

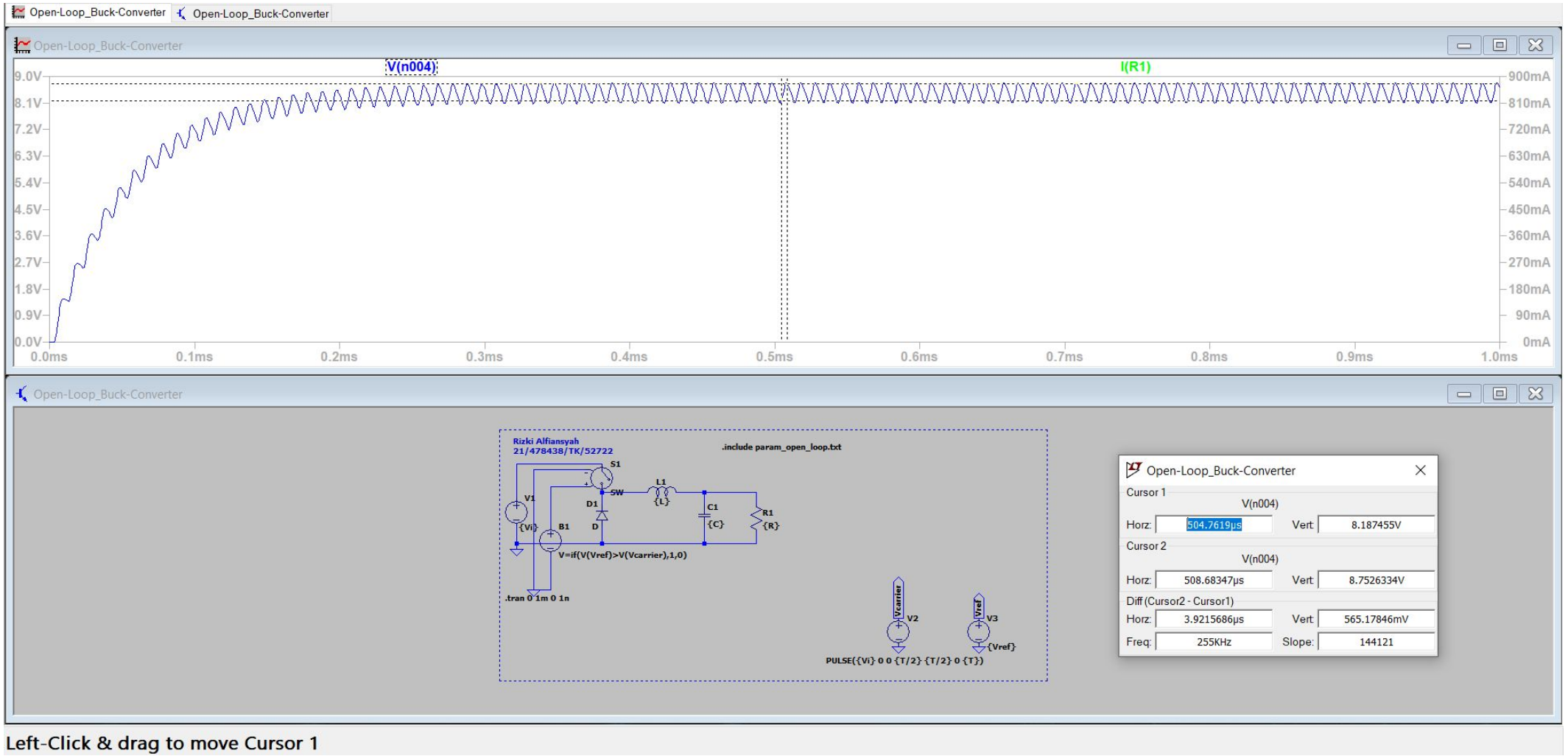




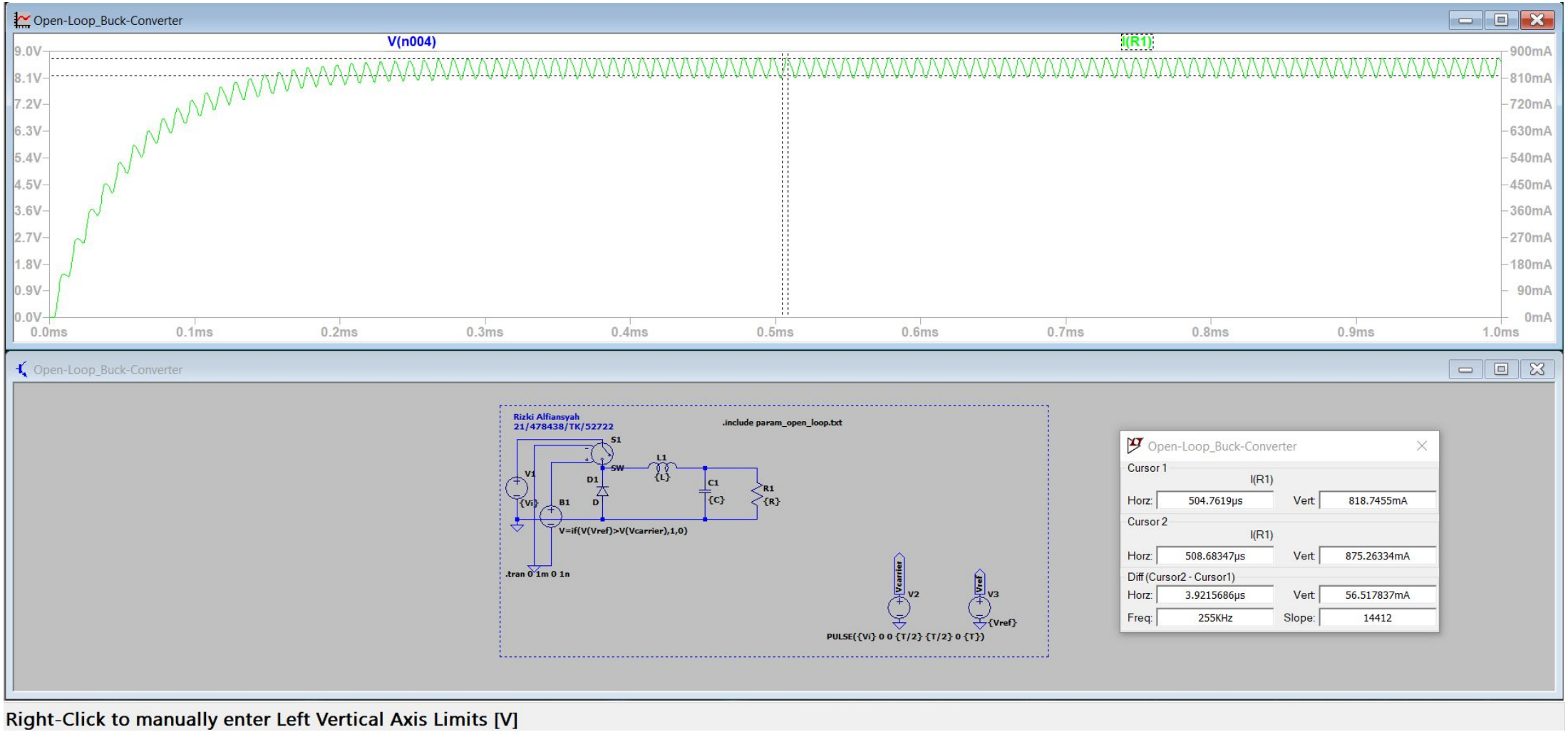
Running Simulation Based on Output Voltage and Current



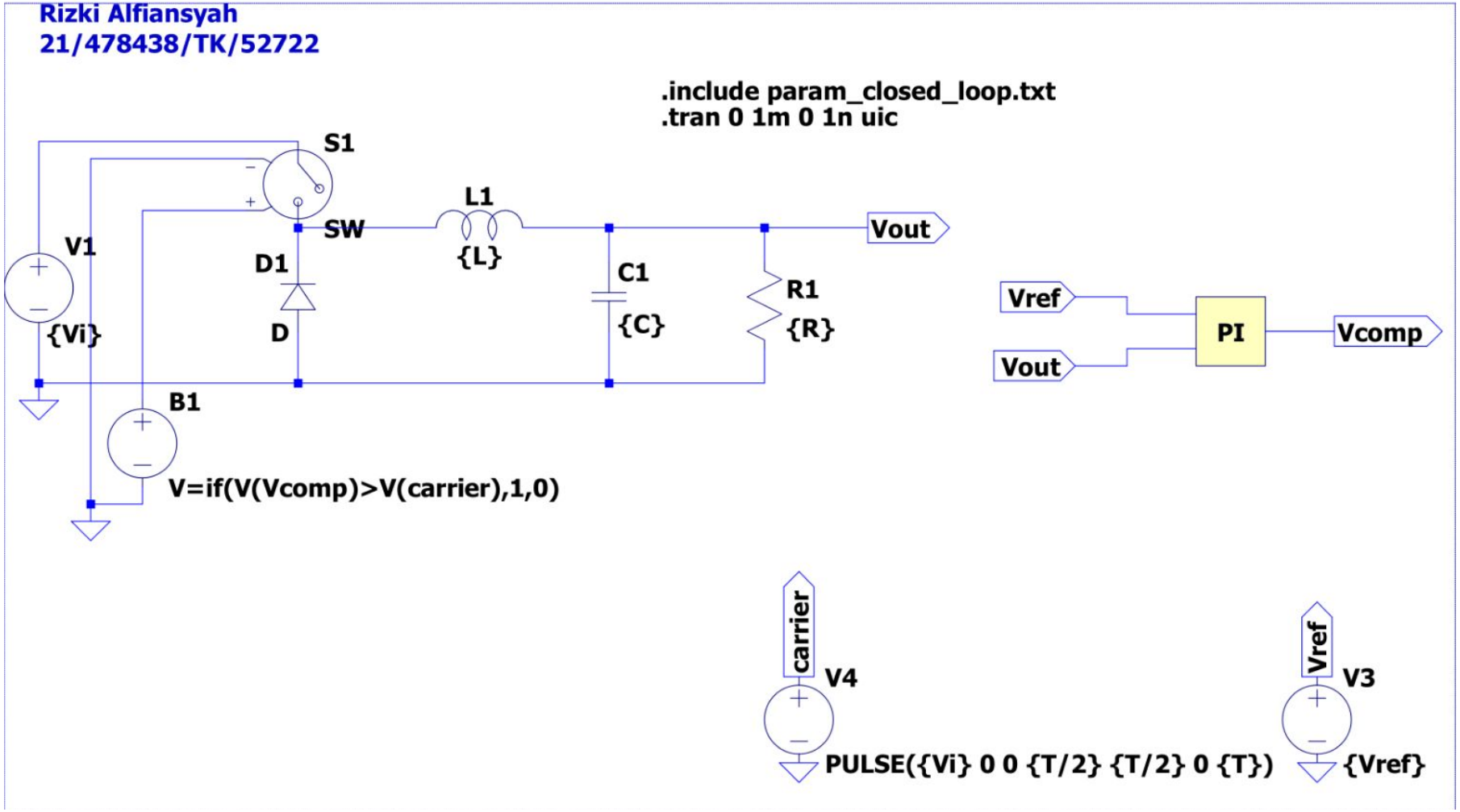
Ripple Voltage on Peak Minimum and Maximum Voltage



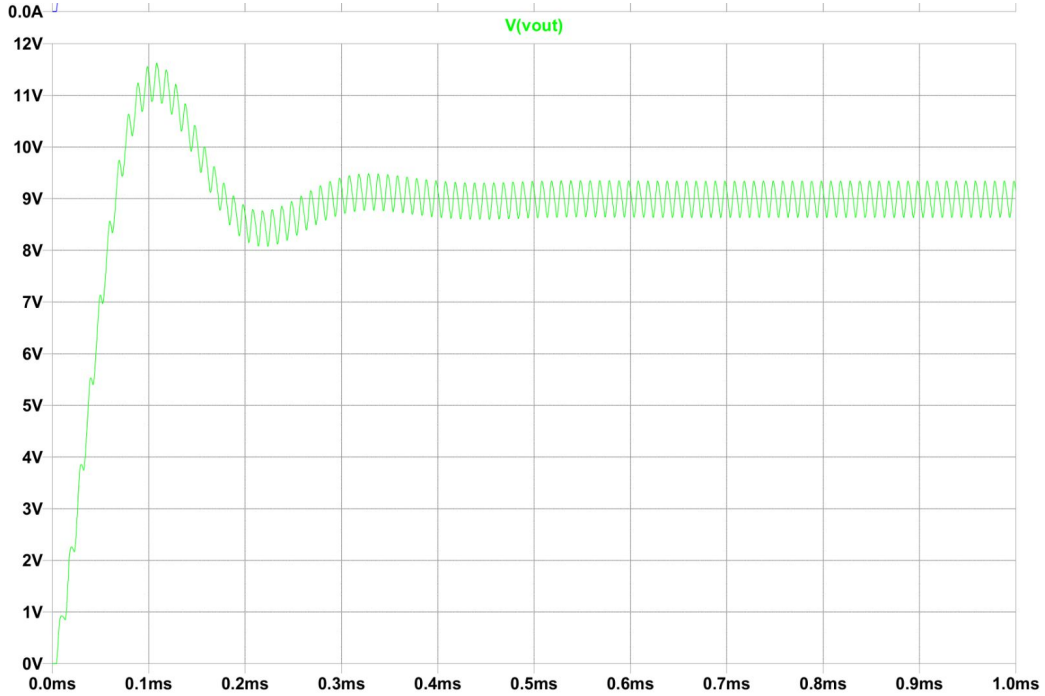
Ripple Current on Peak Minimum and Maximum Current

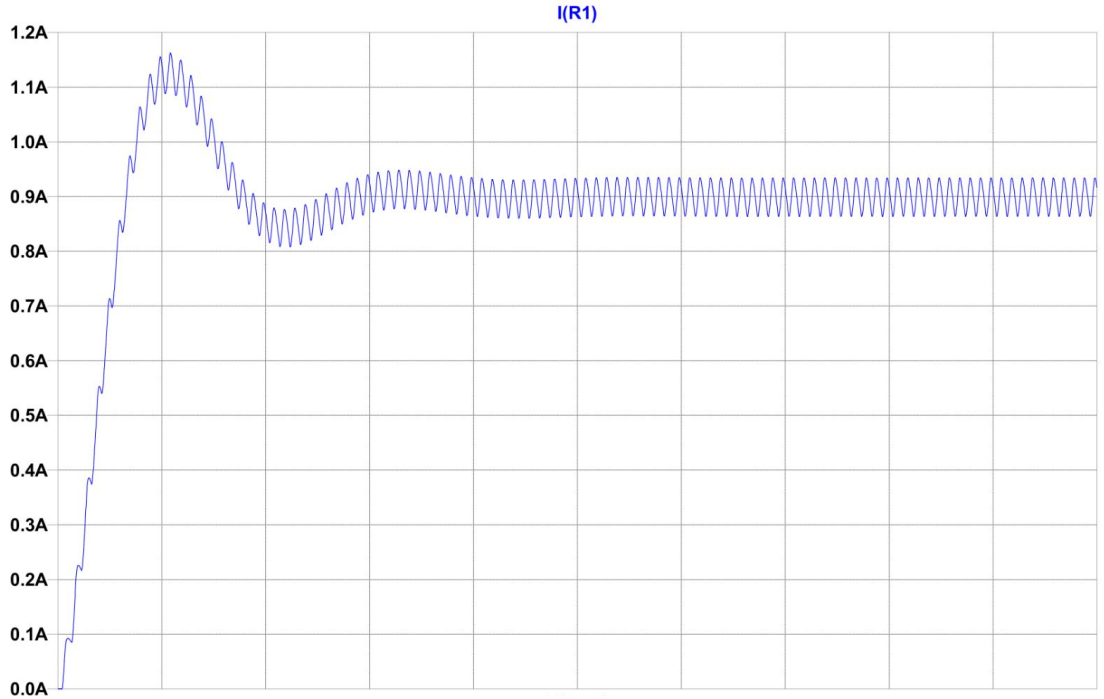


Closed-Loop Buck Converter

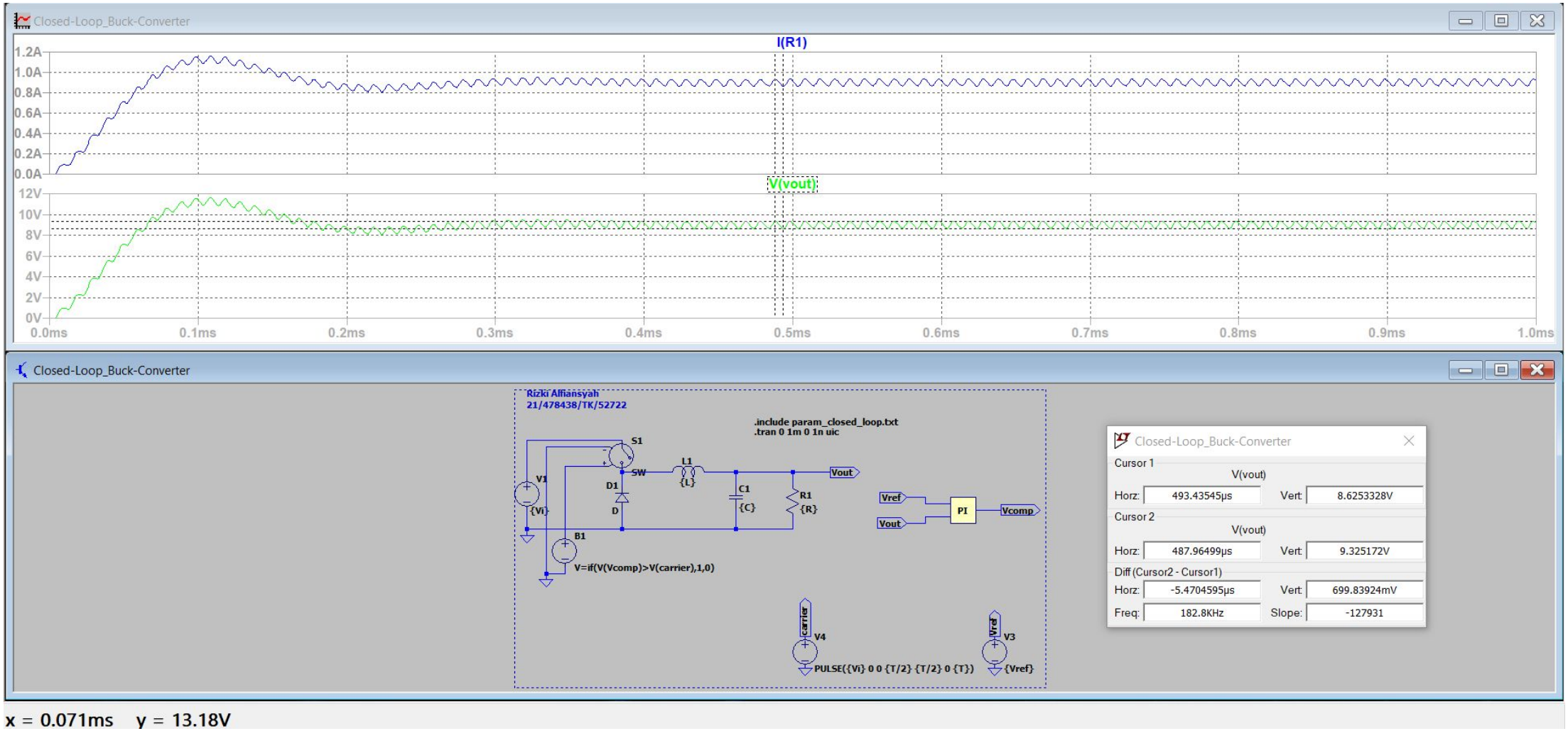


Running Simulation Based on Output Voltage and Current

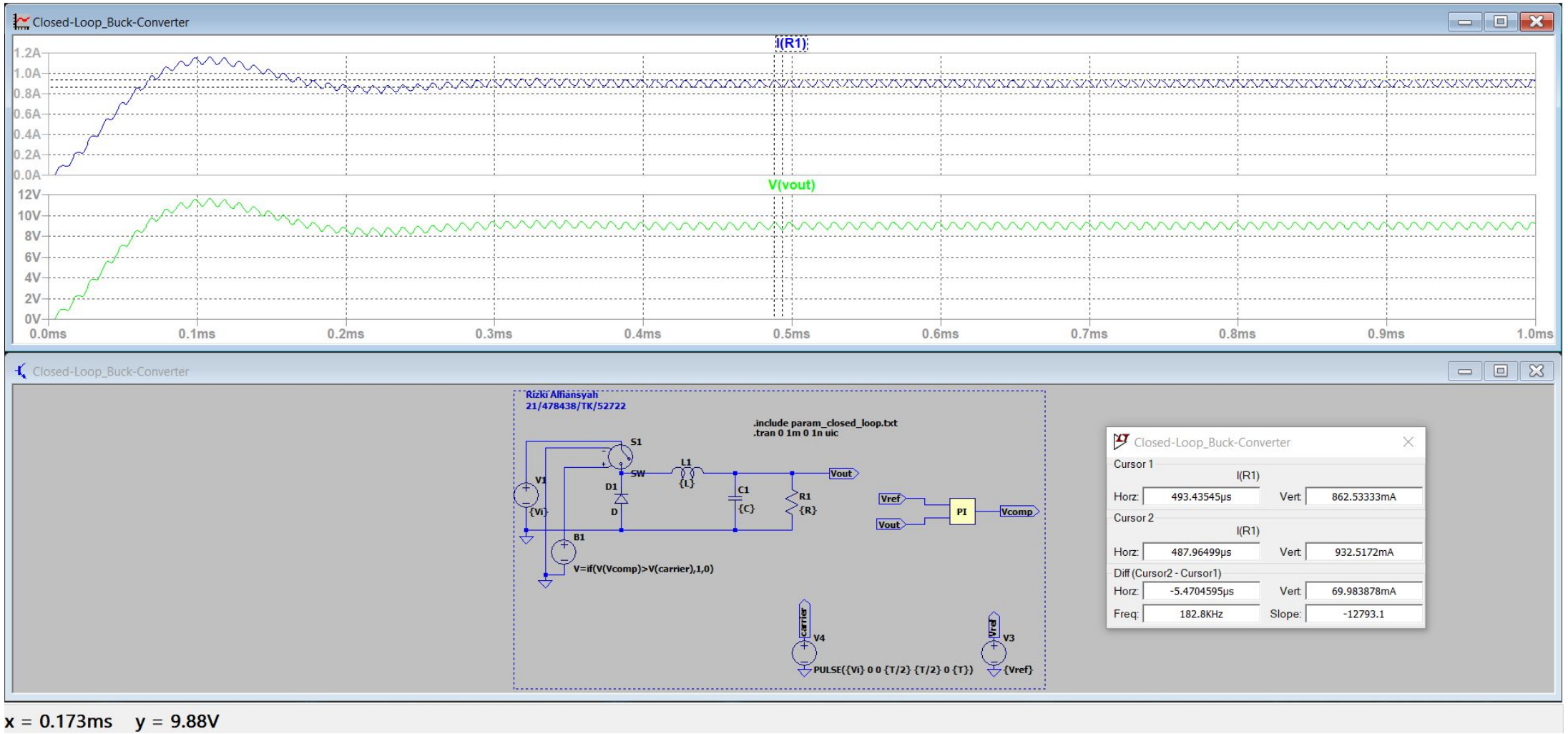




Ripple Voltage on Peak Minimum and Maximum Voltage



Ripple Current on Peak Minimum and Maximum Current



x = 0.173ms y = 9.88V

UNIVERSITAS
GADJAH MADA

PV Grid Connected Inverter

The task involves determining inverter specifications, PV module configuration, and designing a control system that can controls the active and reactive power injected to the grid.

PV Module Configuration

On this condition of PV Grid Connected Inverter, we assume that DC voltage input using 700 Vdc. So, model configuration

$$I_{PV} = \frac{P_n}{V_{dc}}$$

$$I_{PV} = \frac{100000}{700}$$

$$I_{PV} = 142.85\ A$$

Dari kasus diatas, maka dibutuhkan kurang lebih 16 PV dengan tegangan 50 V yang diseri untuk memenuhi kebutuhan Vdc 800 V

Determine L and C Value

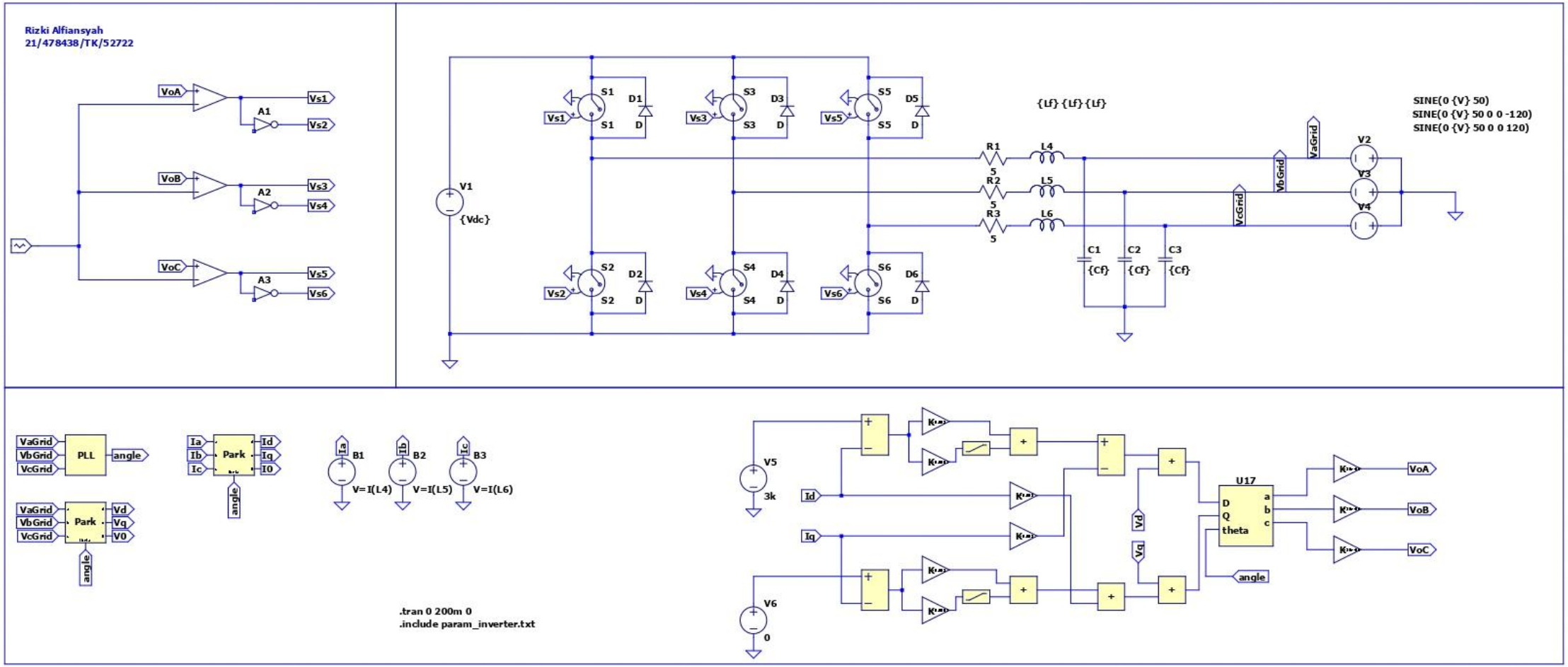
Based on that system, we use RLC filter to downside the ripple on voltage. So, value of L and C can be,

$$\Delta i_L = \frac{0.1 \,.\, P_{n\,\sqrt[2]{2}}}{3V_{ph}} = 20\,A$$

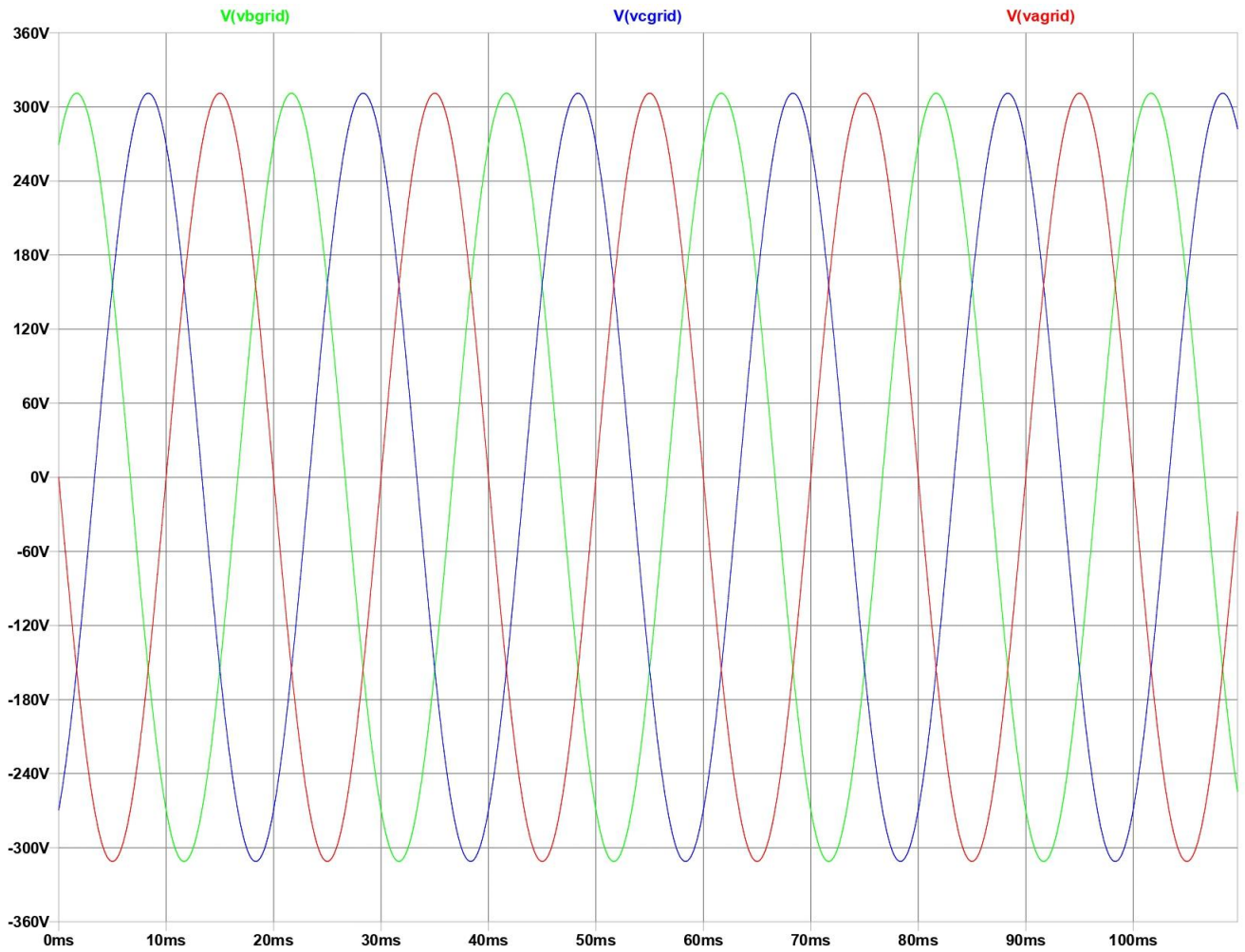
$$V_{dc} = \frac{2\sqrt{2}}{m_i \,.\, \sqrt{3}.\, V_L} = 700\,V$$

$$C_f = 0.03 \times C_{base} = 500\,\mu H$$

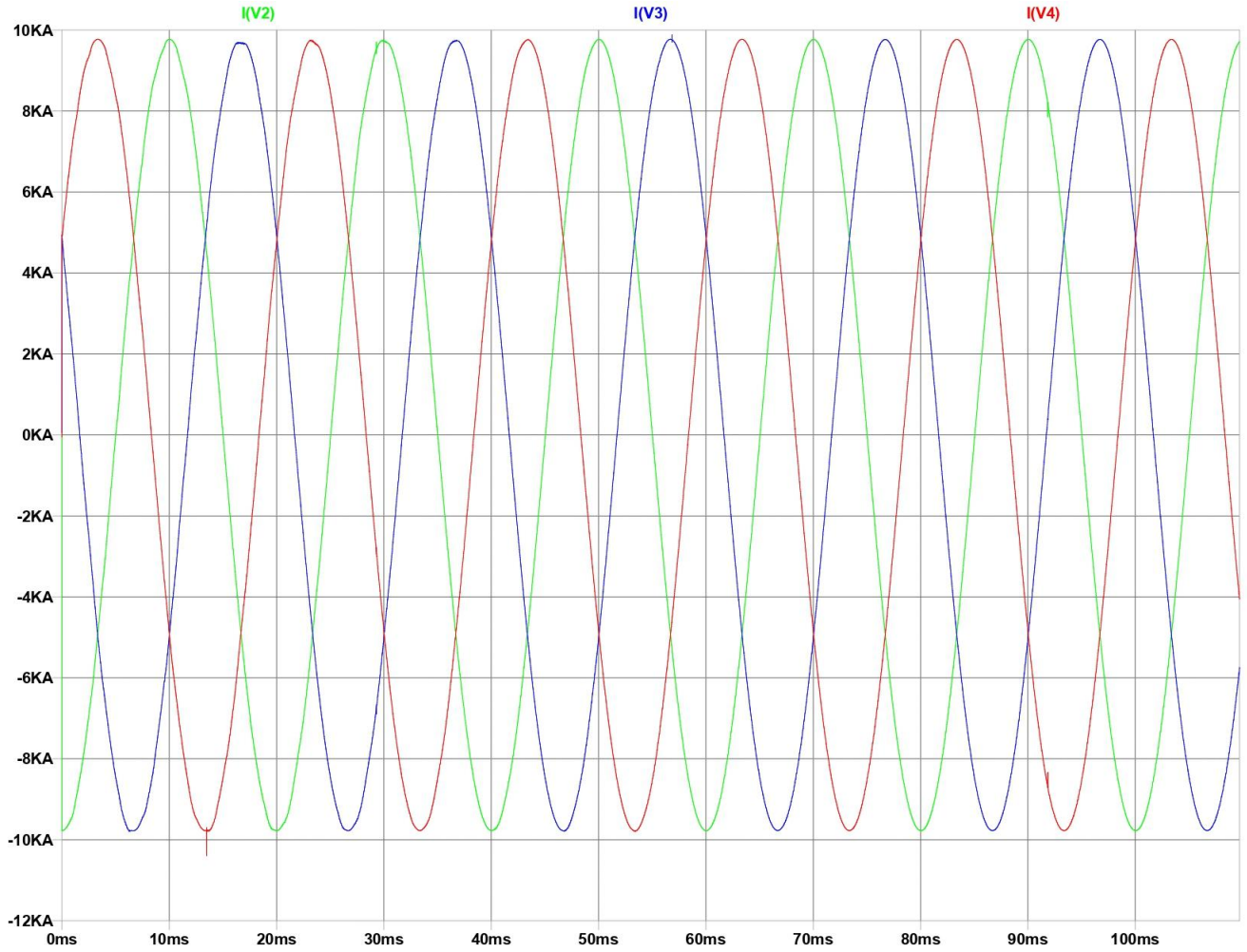
PV Grid Connected Inverter



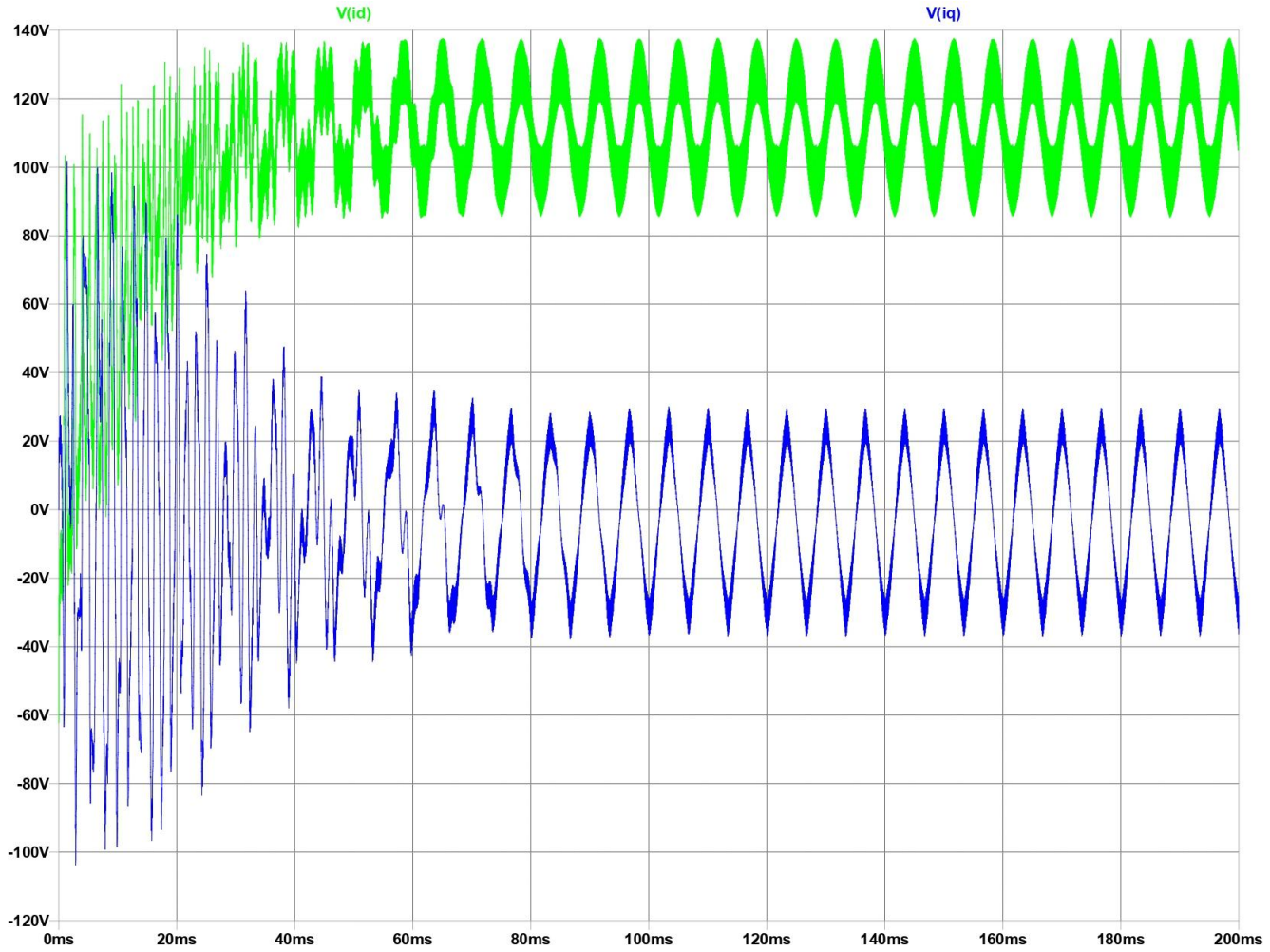
Running Voltage Output to Grid Connected



Running Current Output to Grid Connected



Running Current abc to dq Transformation



UNIVERSITAS
GADJAH MADA

Sekian, dan Terima Kasih