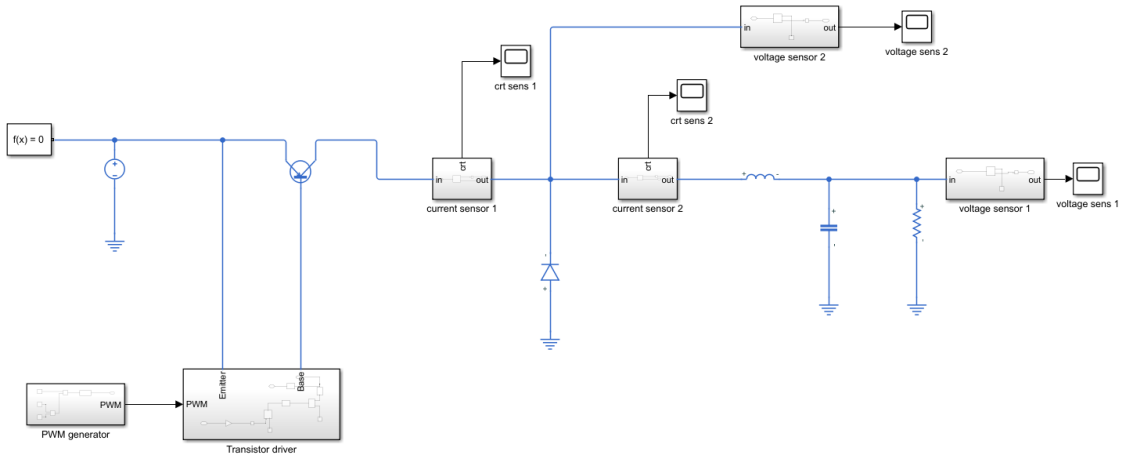
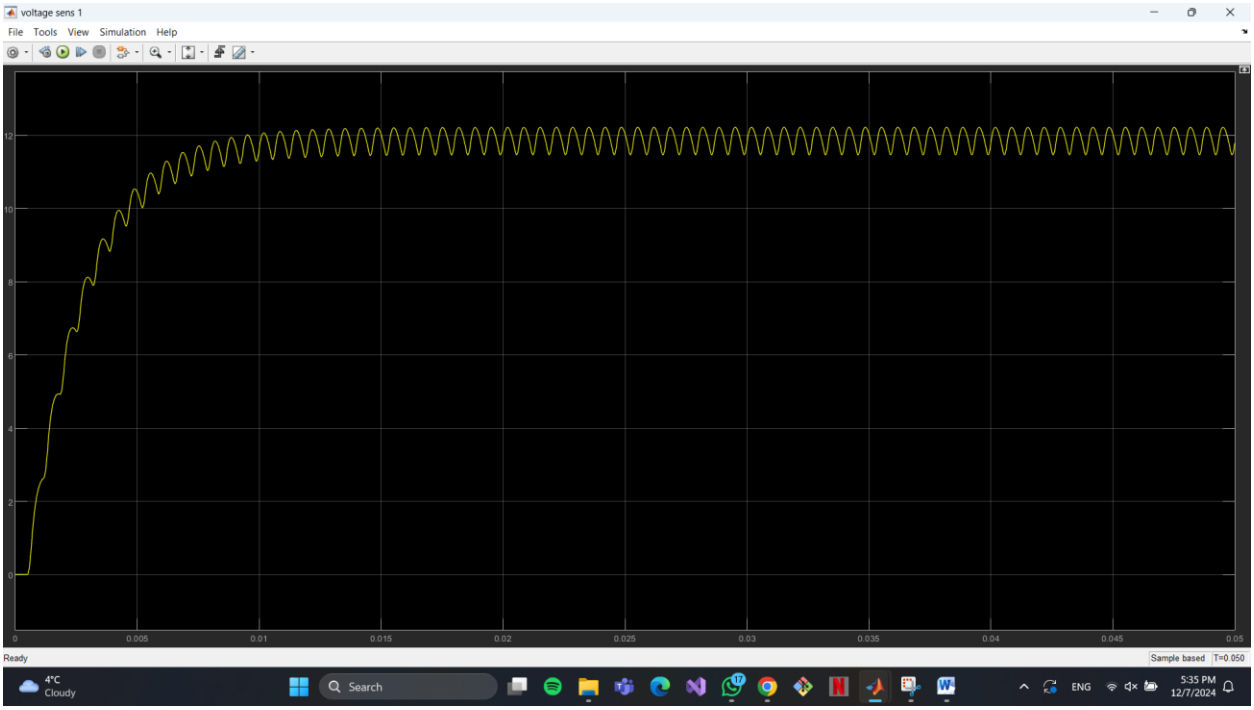
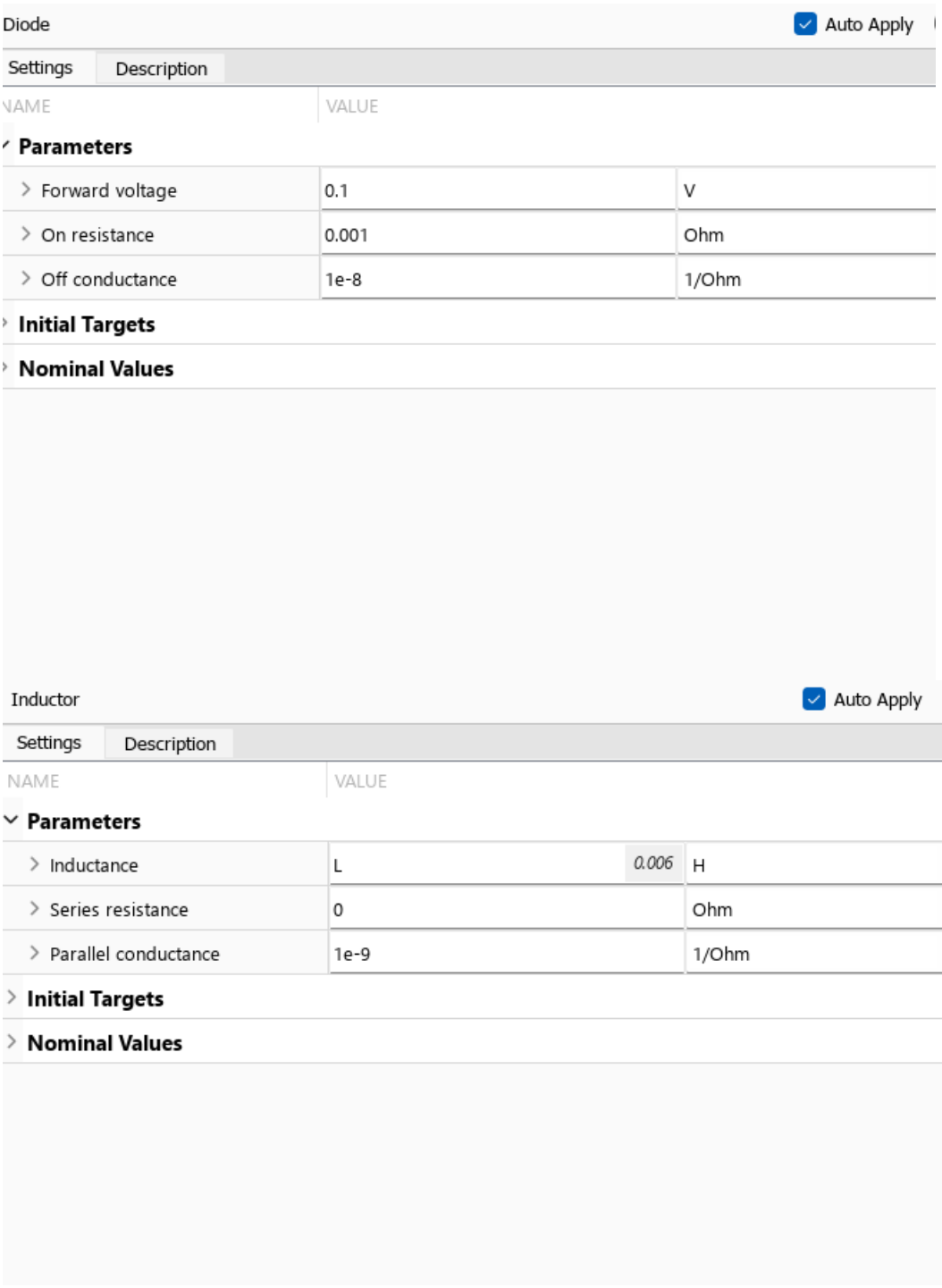
PROJECT PART IV

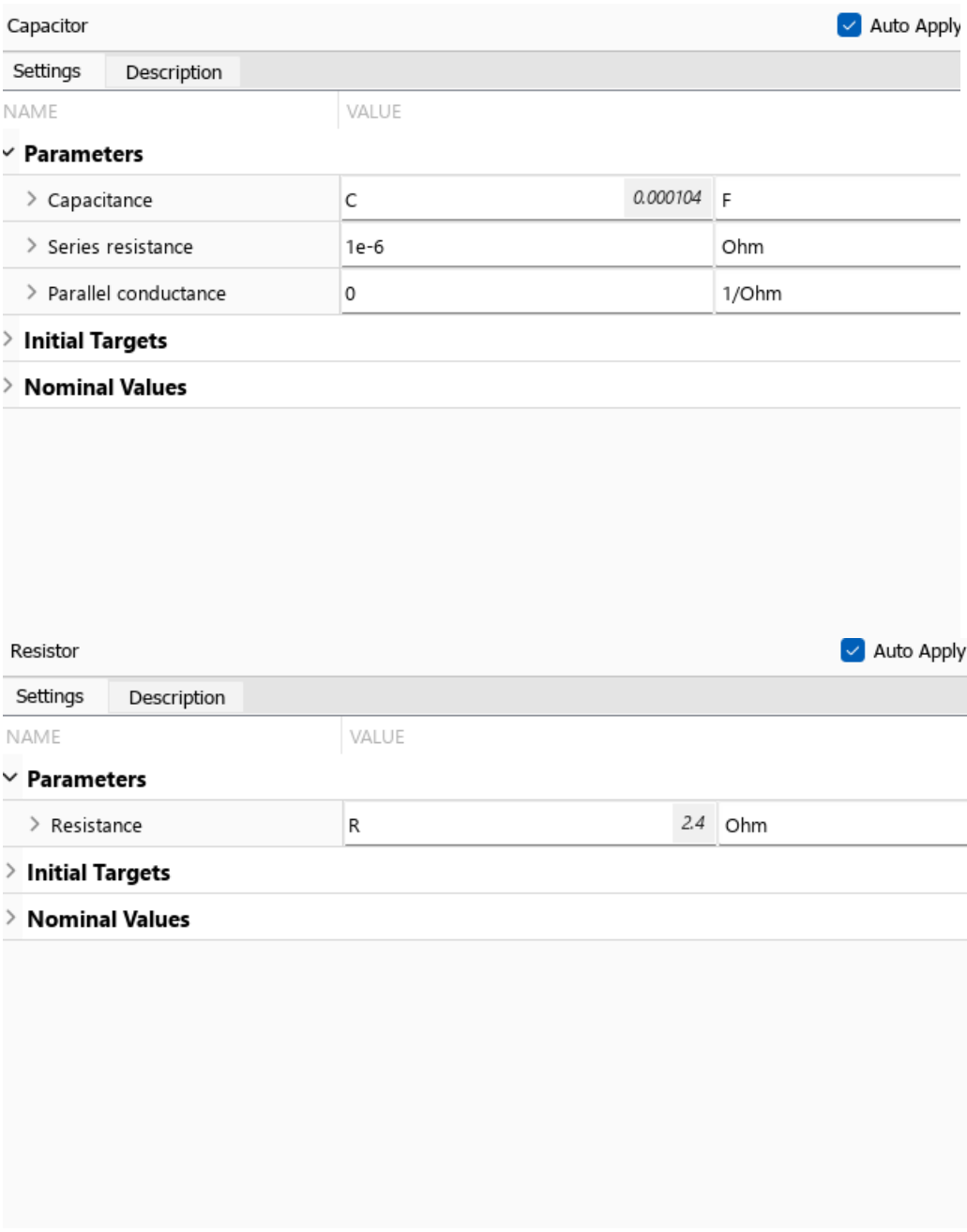
A. Ideal simulation



Output voltage graph:




Diode
Auto Apply
Settings
Description
NAME
VALUE
Parameters
Forward voltage
0.1
V
On resistance
0.001
Ohm
Off conductance
1e-8
1/Ohm
Initial Targets
Nominal Values
Inductor
Auto Apply
Settings
Description
NAME
VALUE
Parameters
Inductance
L
0.006
H
Series resistance
0
Ohm
Parallel conductance
1e-9
1/Ohm
Initial Targets
Nominal Values

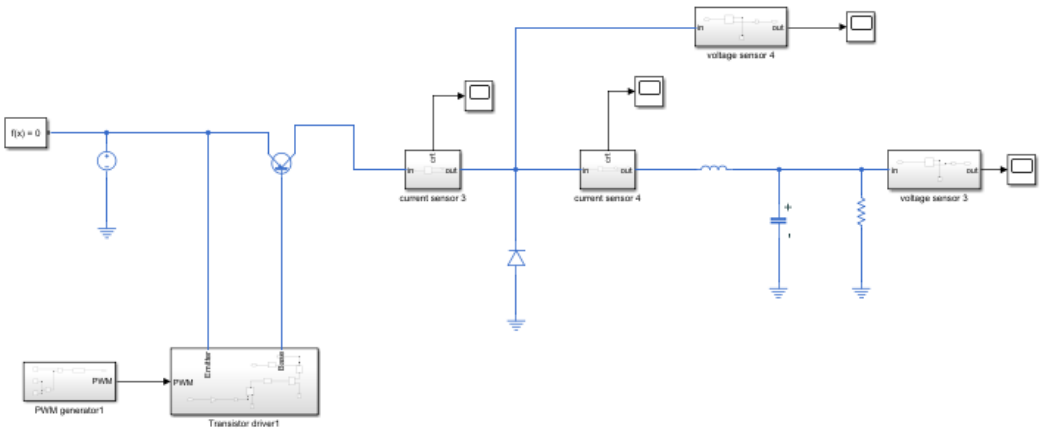


Code:

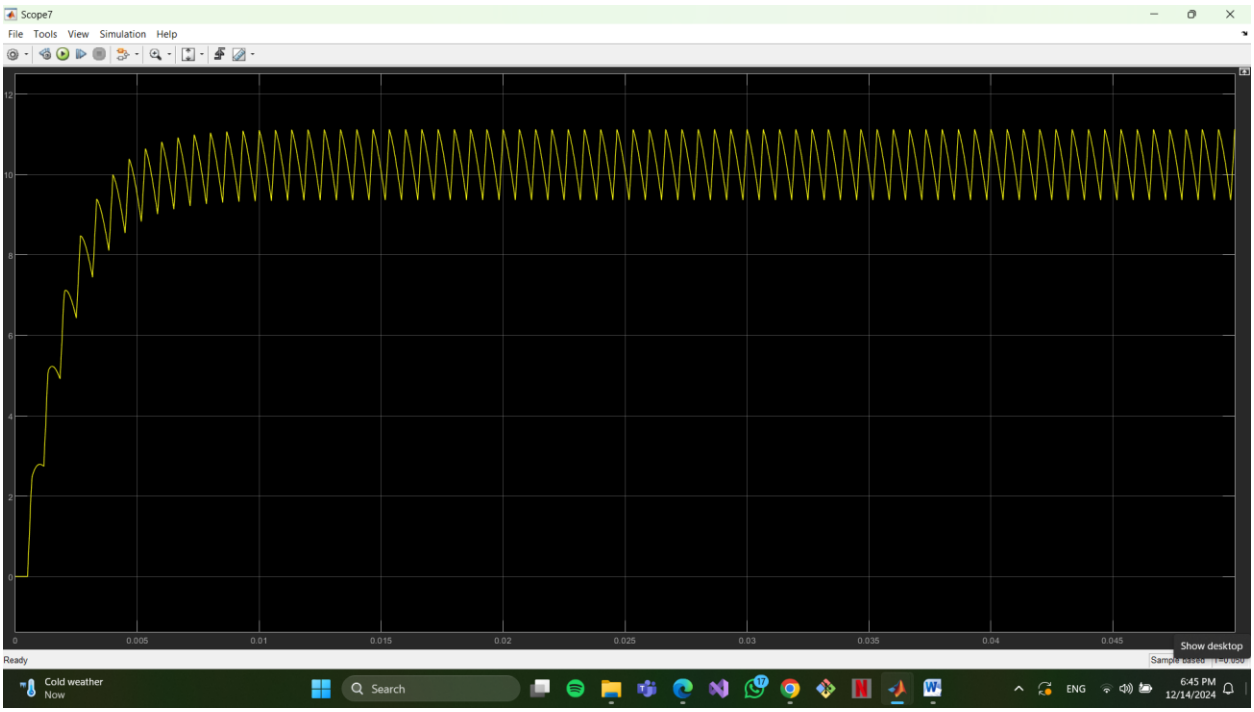
```
U_in = 48;
U_out = 12;
frequency = 1500;
R = 2.4;

L = 0.006;
C = 0.000104;
I_out = 5;
```

B. With residual elements



Output voltage graph:



Diode

Auto Apply

Settings | Description

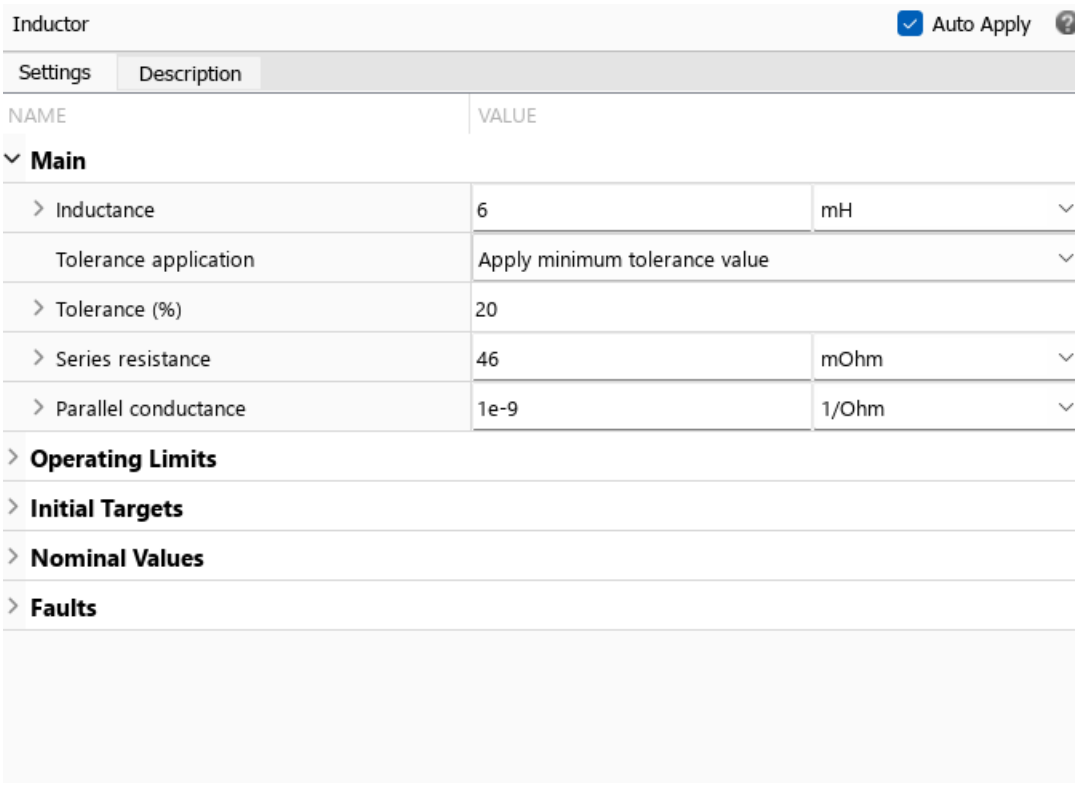
NAME	VALUE	
Parameters		
Forward voltage	670	mV
On resistance	0.3	Ohm
Off conductance	1e-8	1/Ohm
Initial Targets		
Nominal Values		

Capacitor

Auto Apply

Settings | Description

NAME	VALUE	
Main		
Capacitance model	Constant	
Capacitance	100	uF
Tolerance application	Apply minimum tolerance value	
Capacitance tolerance (%)	20	
Series resistance	2.86624	Ohm
Parallel conductance	0	1/Ohm
Operating Limits		
Initial Targets		
Nominal Values		
Faults		


Inductor
Auto Apply
Settings
Description
NAME
VALUE
Main
Inductance
6
mH
Tolerance application
Apply minimum tolerance value
Tolerance (%)
20
Series resistance
46
mOhm
Parallel conductance
1e-9
1/Ohm
Operating Limits
Initial Targets
Nominal Values
Faults

Observations based on comparison of performances:

- Output voltage:

In the ideal simulation, there are no losses or tolerances so the output voltage closely matches the target value.

The output voltage in the system with residual elements deviates a little because of losses like diode forward voltage, ESR in the capacitor, and DCR in the inductor.

- Efficiency:

Since there are no power losses, the ideal system operates as efficiently as possible.

In the residual system the efficiency is reduced because of: power losses related to tolerances, energy dissipation across the diode, inductor and capacitor resistances.

- Effect of tolerances:

The stability of the system is directly impacted by tolerances in the inductor and capacitor.

Inductor tolerance: results in subtle variations of energy which slightly affects the output voltage stability.
Capacitor tolerance: causes an increased ripple.

- Conclusions:

The ideal simulation provides a foundation for the system's optimal performance.

The residual simulation highlights the real limitations of the system, underlining the impact of component properties and tolerances on performance.