EXPERIMENT 4: Single phase rectifiers

Name -
Mehul Kavdia (2018A8PS0860P)
Yash Raj Agarwal (2018A8PS0782P)
Pranamya Jain (2018A8PS0769P)
Jash Shah (2018A8PS0507P)

Sec No. - 4 **Group No.** - 10

Date - 17/03/21

Objective - To study load voltage and current waveforms of single-phase full wave rectifiers under:

a) Controlled rectification

b) Uncontrolled rectification

c) Midpoint rectification

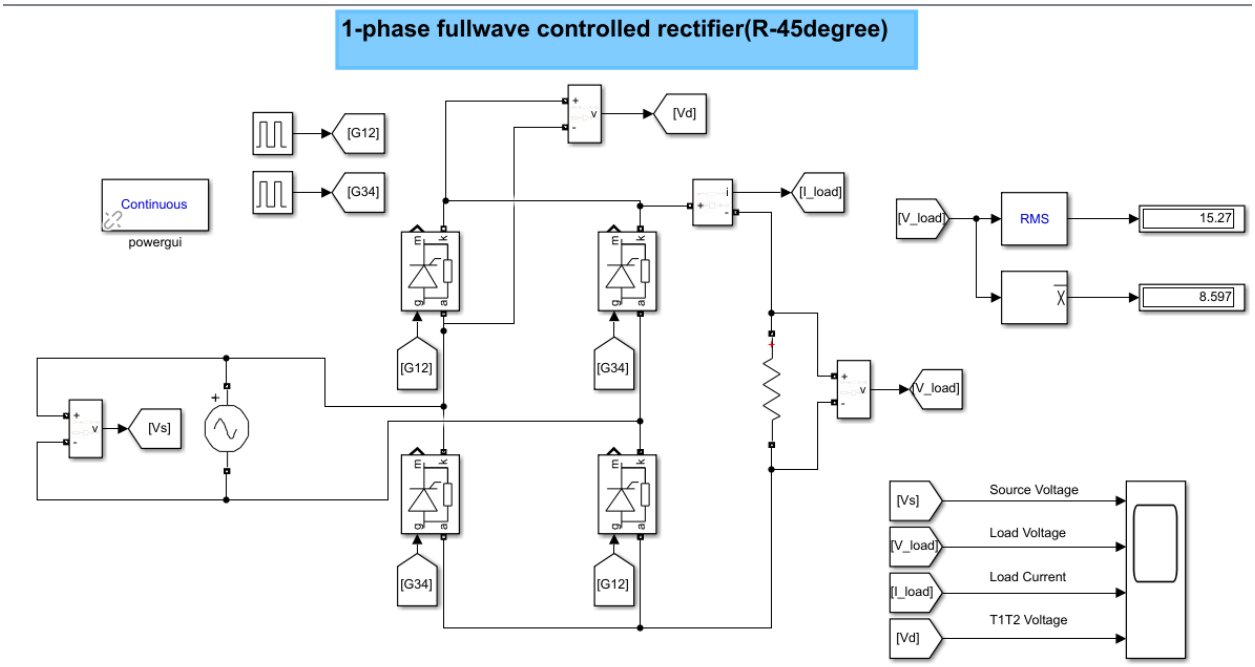
for firing angles α = 45, 60 and 90 deg respectively.

Software tool: MATLAB Simulink, Simscape toolbox (power GUI)

Components used:

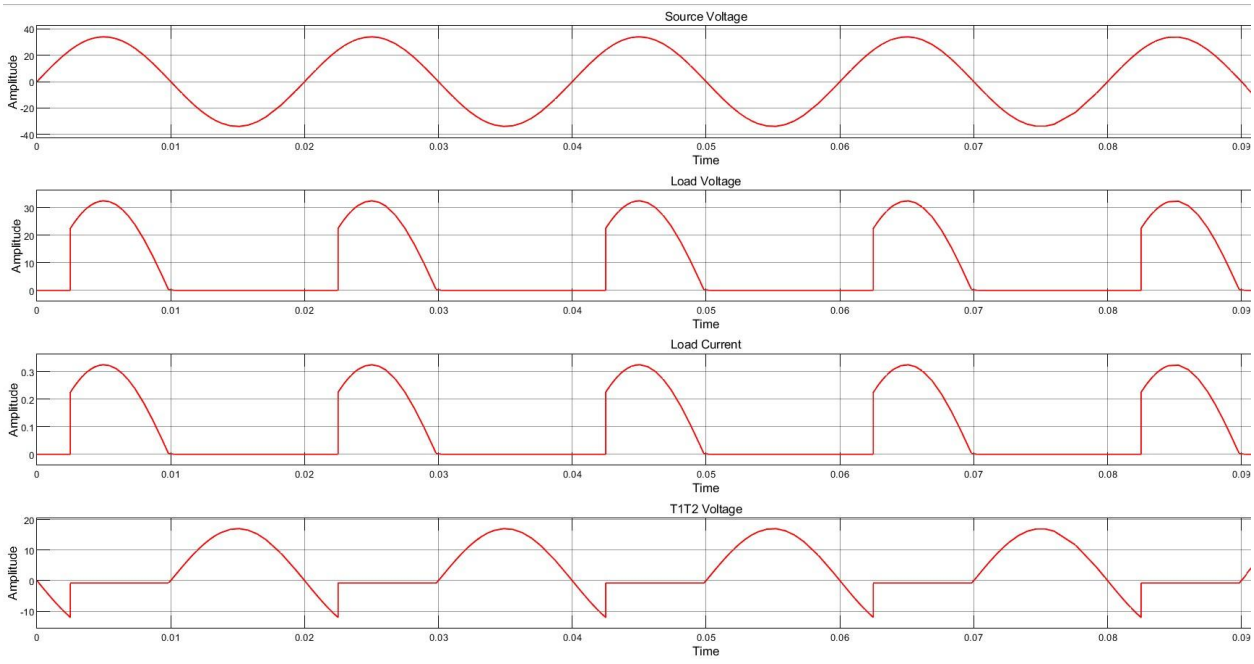
Detailed thyristor; Diode; AC source; Step-down transformer; Pulse generator; Resistor, inductor and constant dc-side voltages as load; Voltage and current sensors; Display; Scope

1. Single phase full wave controlled rectifier - R load(100 ohms)

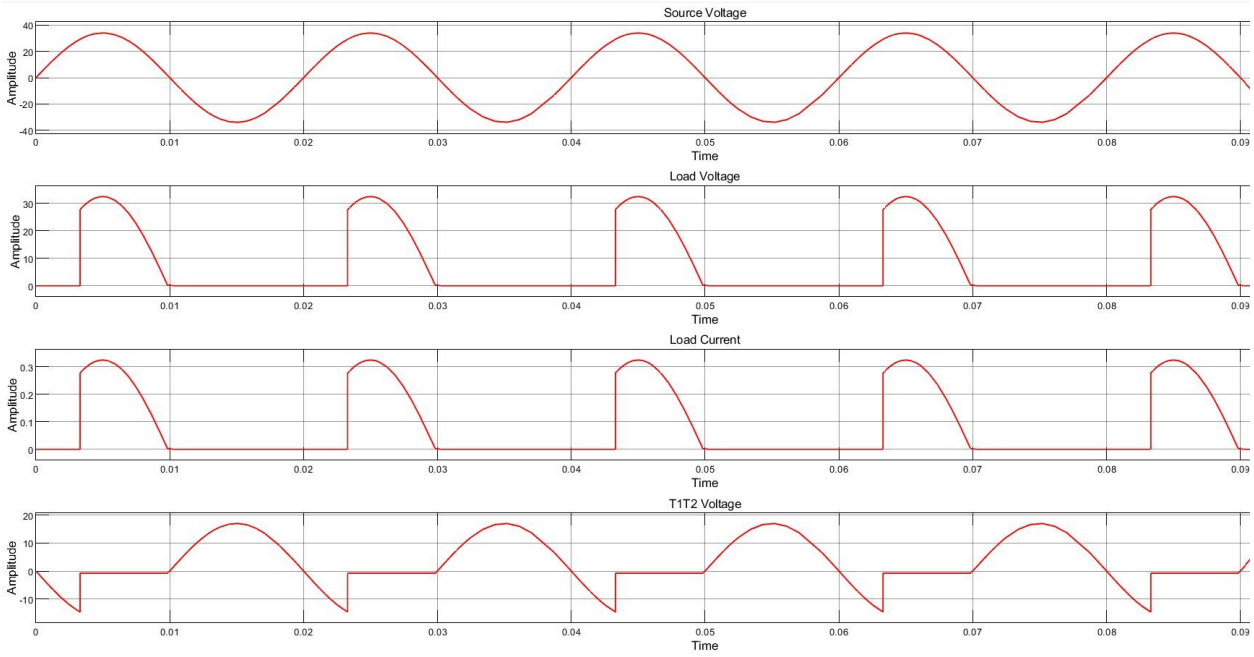


1(a) α = 45°

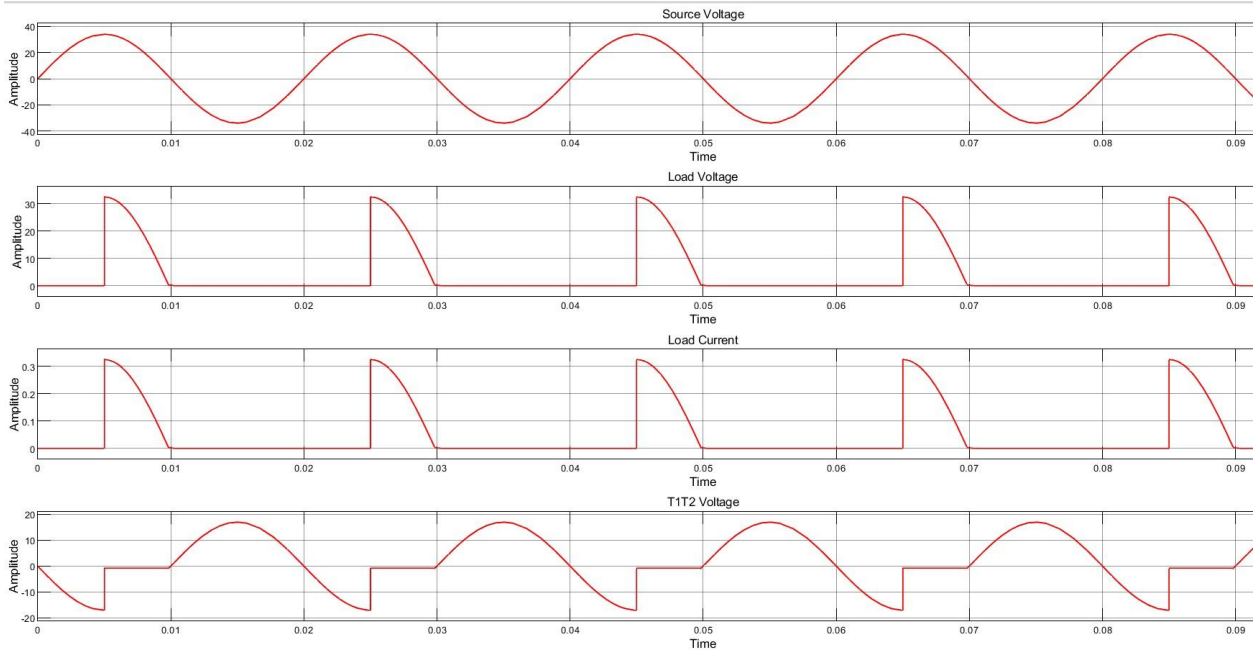
Vrms = 15.27V, Vavg = 8.597V



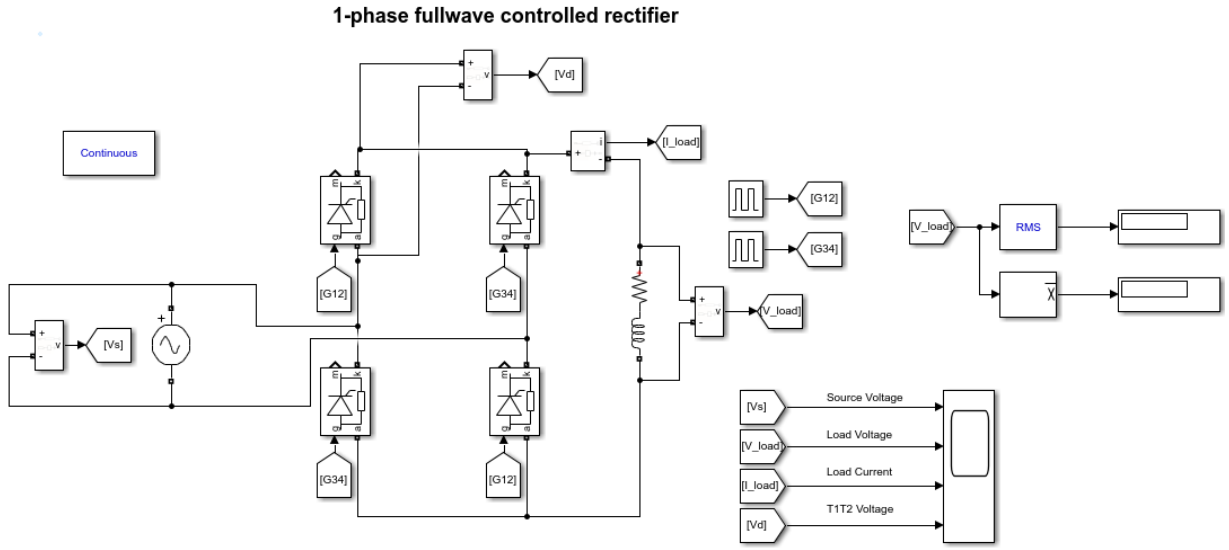
1(b) α = 60°
Vrms = 14.45V, Vavg = 7.6V



1(c) α = 90°
Vrms = 11.34V, Vavg = 5V

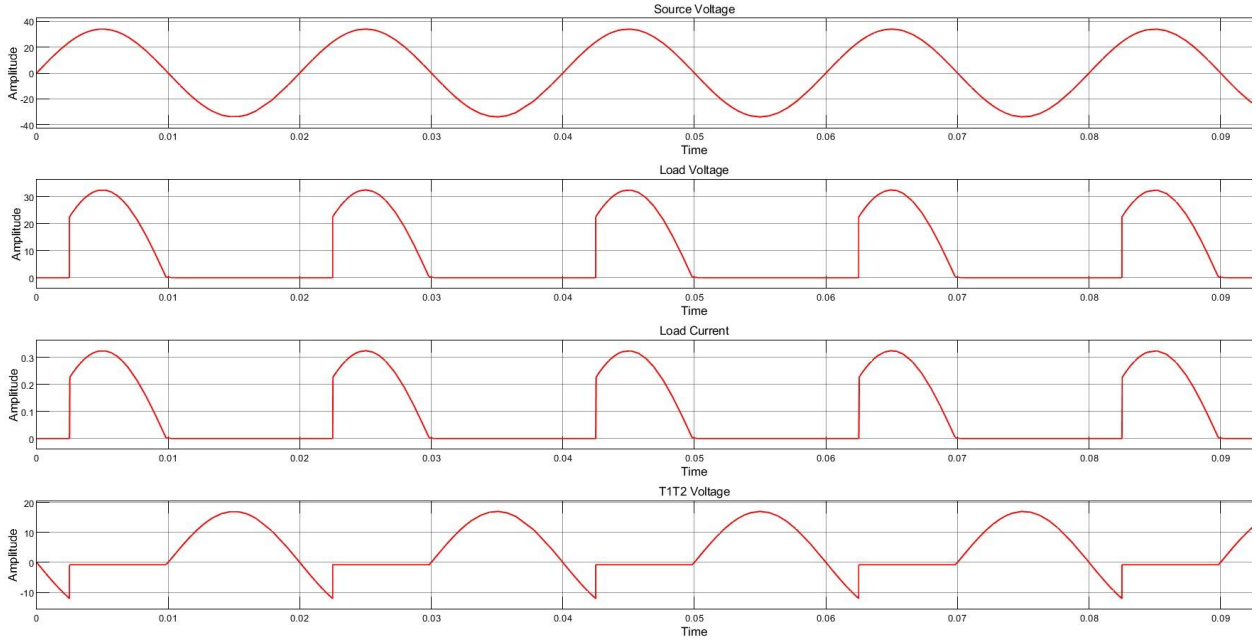


2. Single phase full wave controlled rectifier RL load(100 ohms, 150uH)



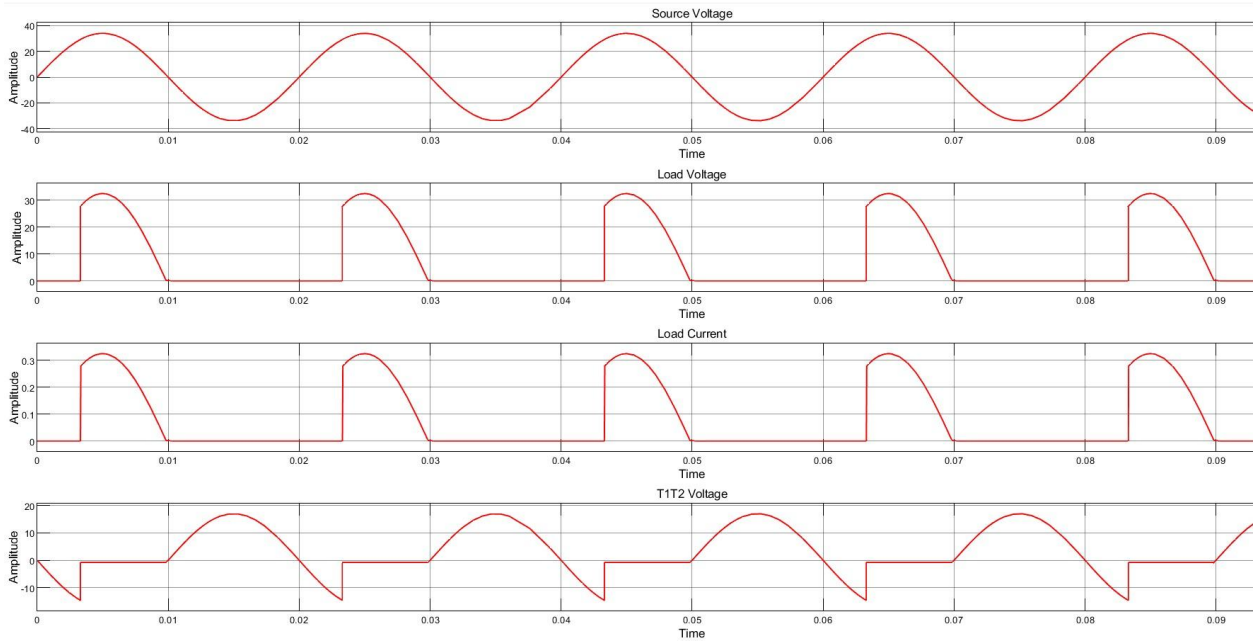
2(a) α = 45°

Vrms = 15.26V, Vavg = 8.596V



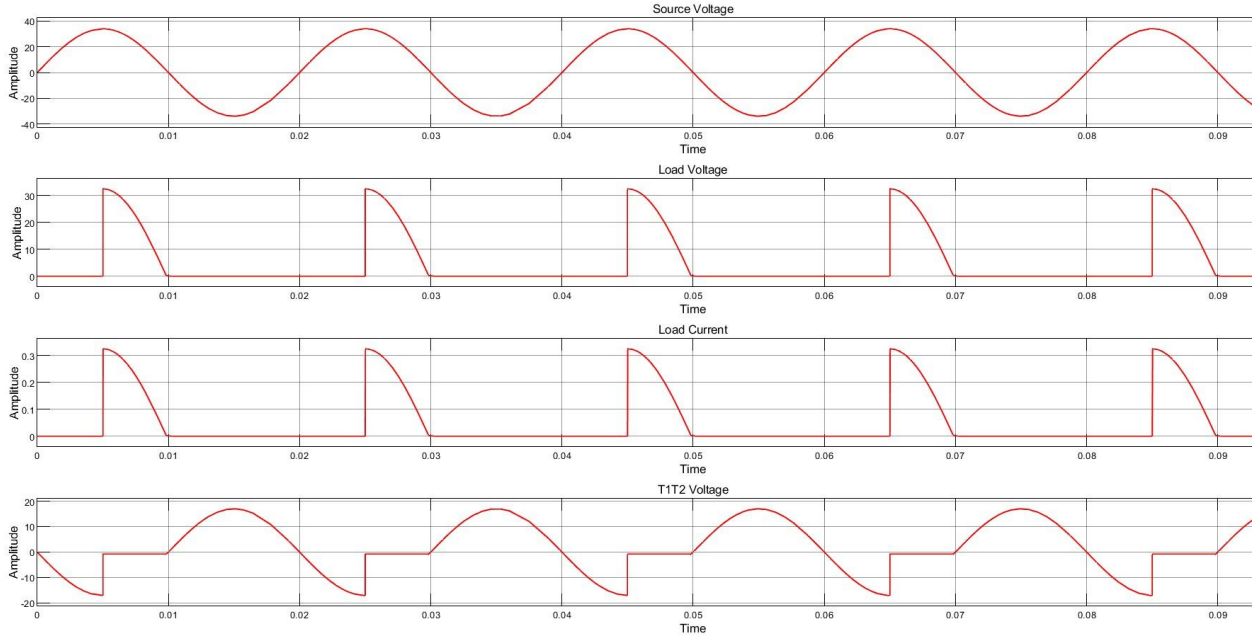
2(b) α = 60°

Vrms = 14.43V, Vavg = 7.6V

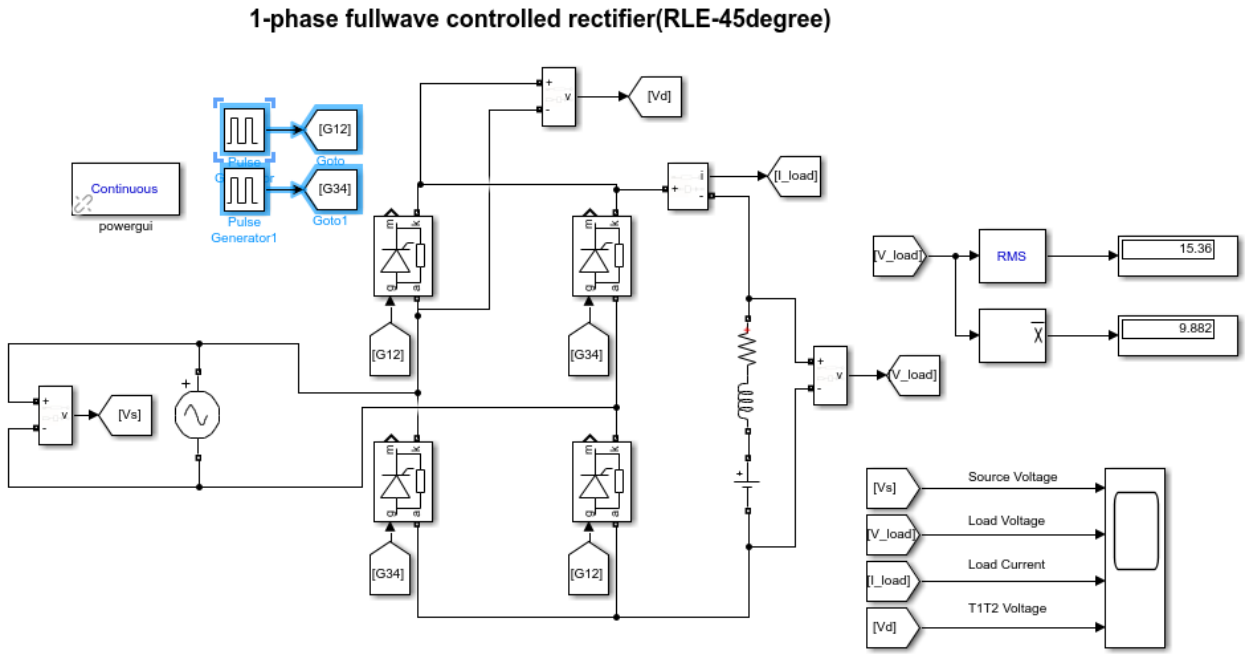


2(c) α = 90°

Vrms = 11.33V, Vavg = 5V

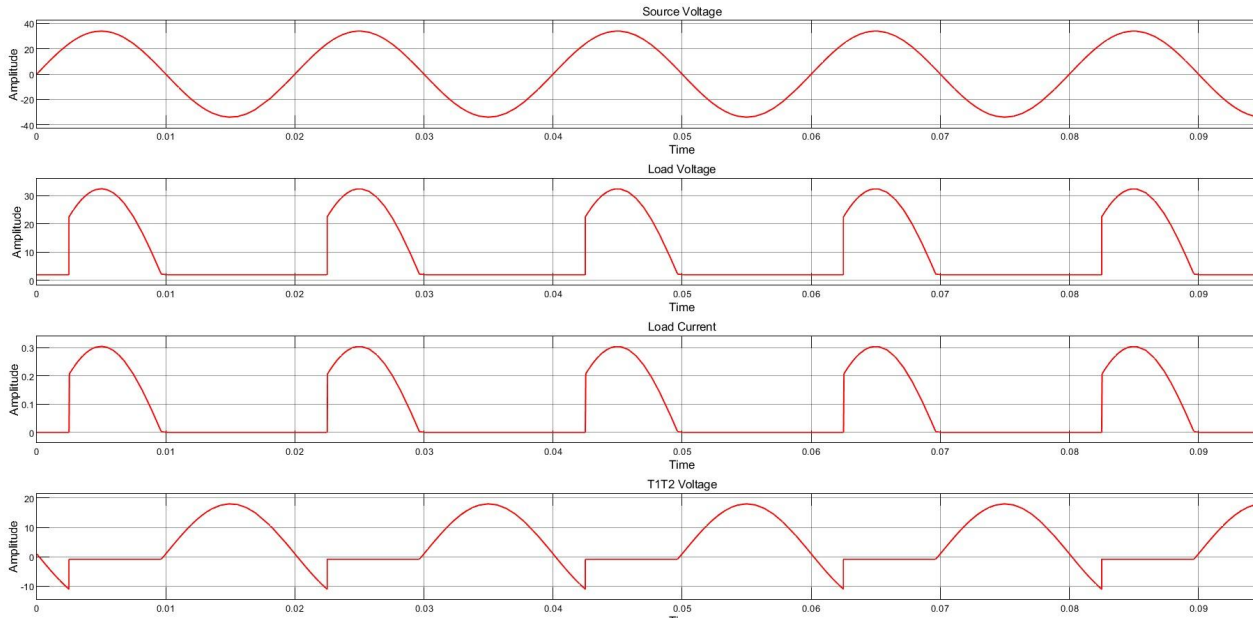


3. Single phase full wave controlled rectifier RLE load(100 ohms, 150uH, 2V)



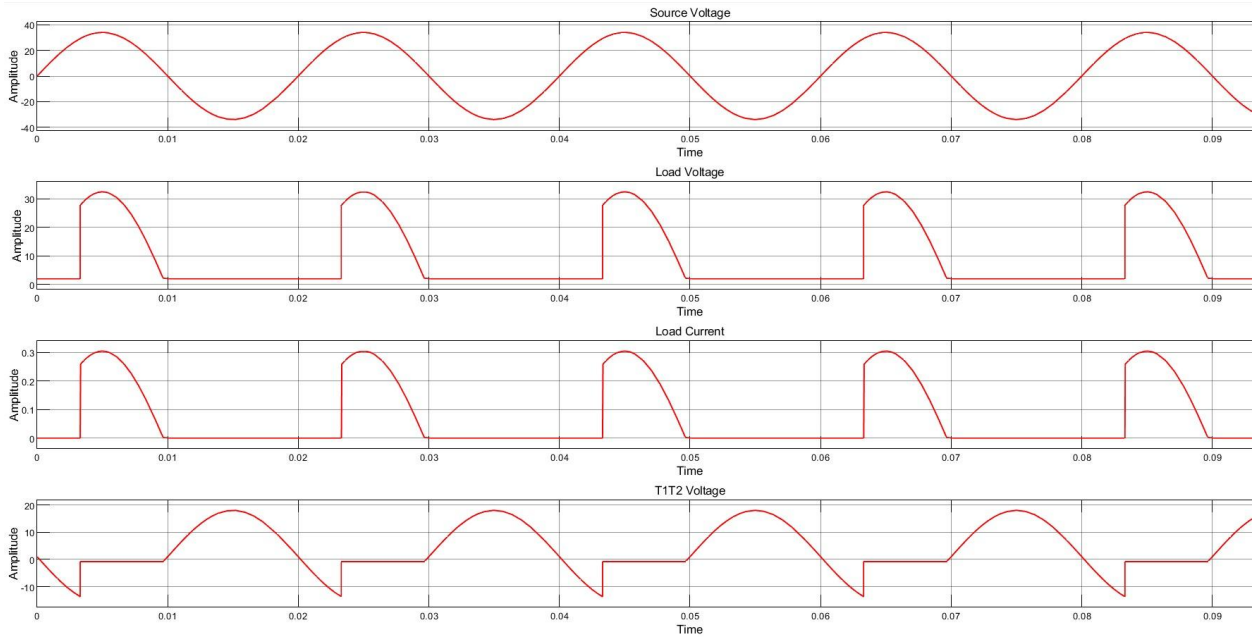
3(a) α = 45°

Vrms = 15.36V, Vavg = 9.882V



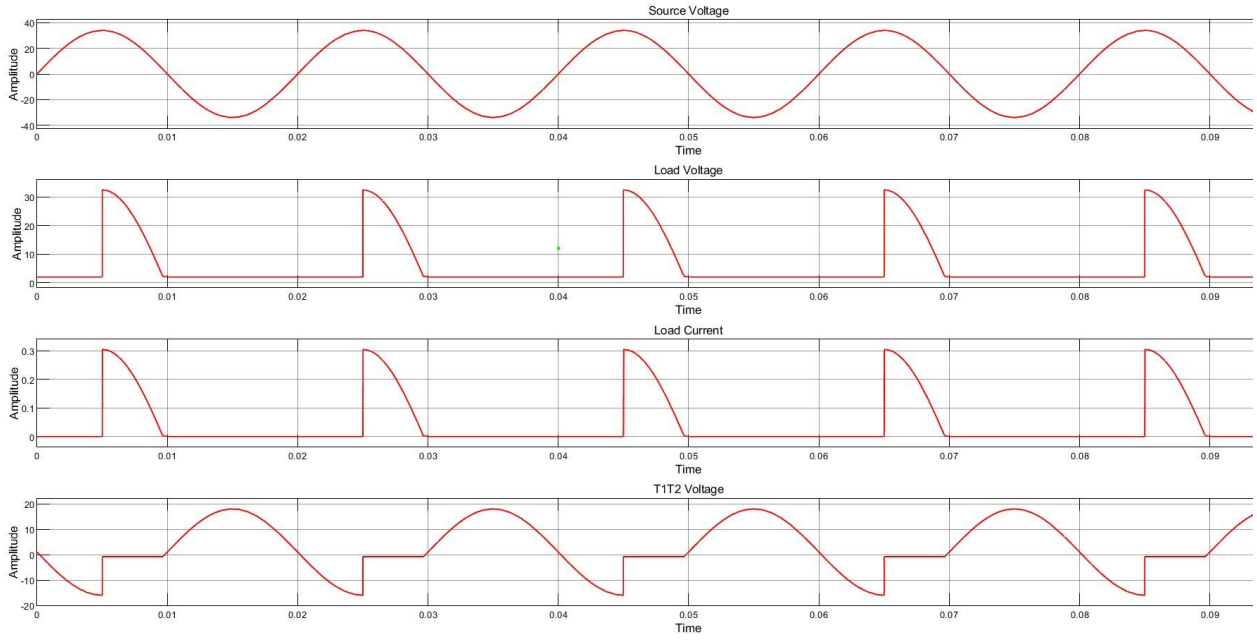
3(b) α = 60°

Vrms = 14.53V, Vavg = 8.95V



3(c) α = 90°

Vrms = 11.45V, Vavg = 6.54V

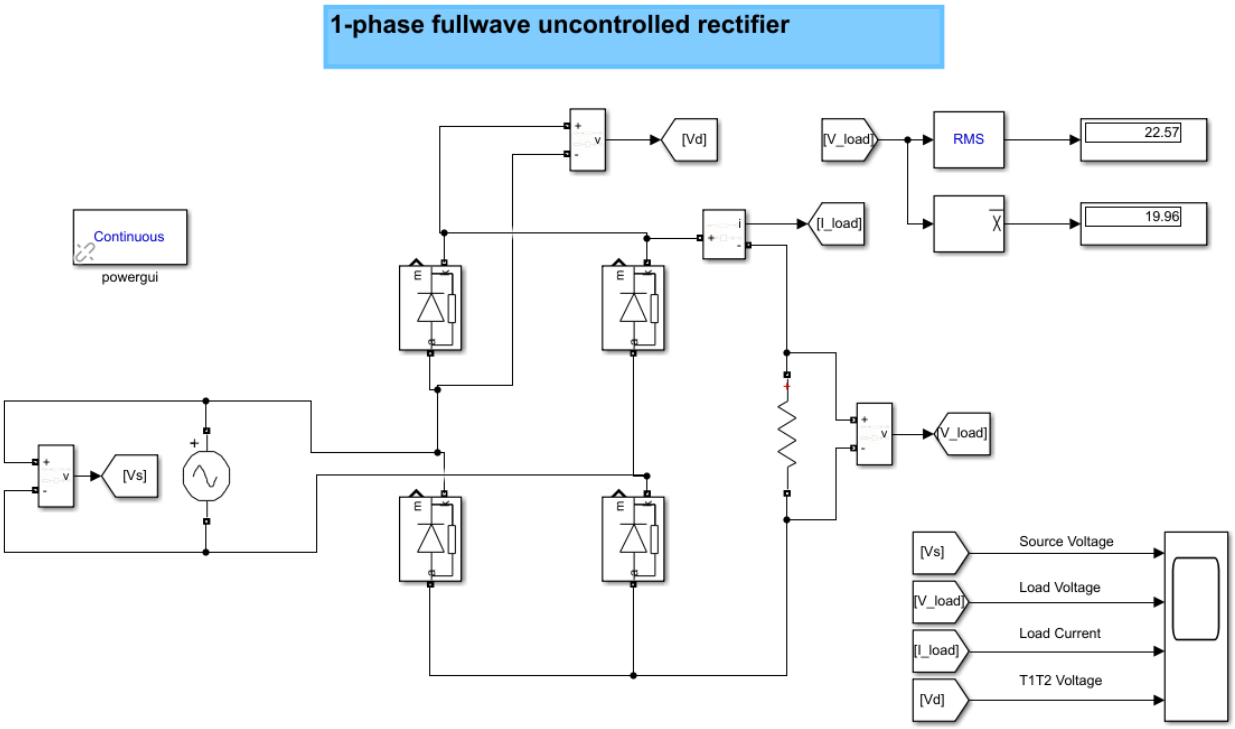


Controlled Full wave rectifier table:

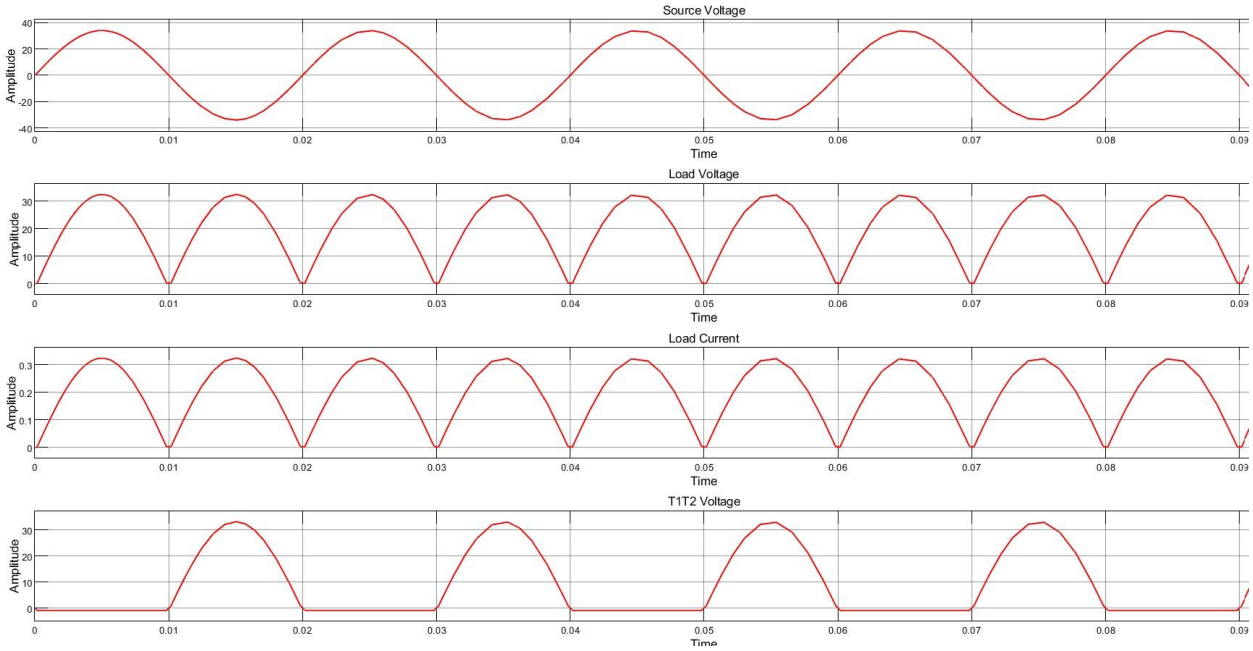
Components	α	Output Voltage (Vd)	
		Practically	Theoretically
R			
	45°	21.59	18.475
	60°	20.4	16.234
	90°	15.99	10.82
RL			
	45°	21.60	18.475
	60 °	20.41	16.234
	90°	15.99	10.82
RLE			
	45°	21.61	18.475

	60°	**20.44**	**16.234**
	90°	**16.06**	**10.82**

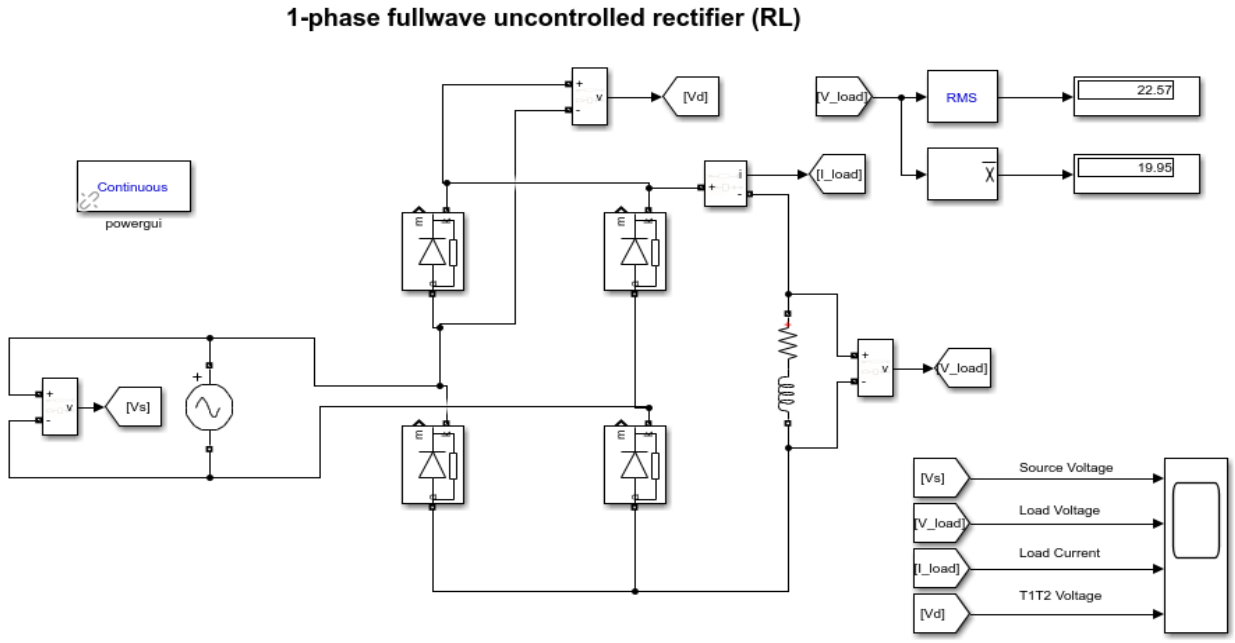
4. Single phase full wave uncontrolled rectifier R load(100 ohms)



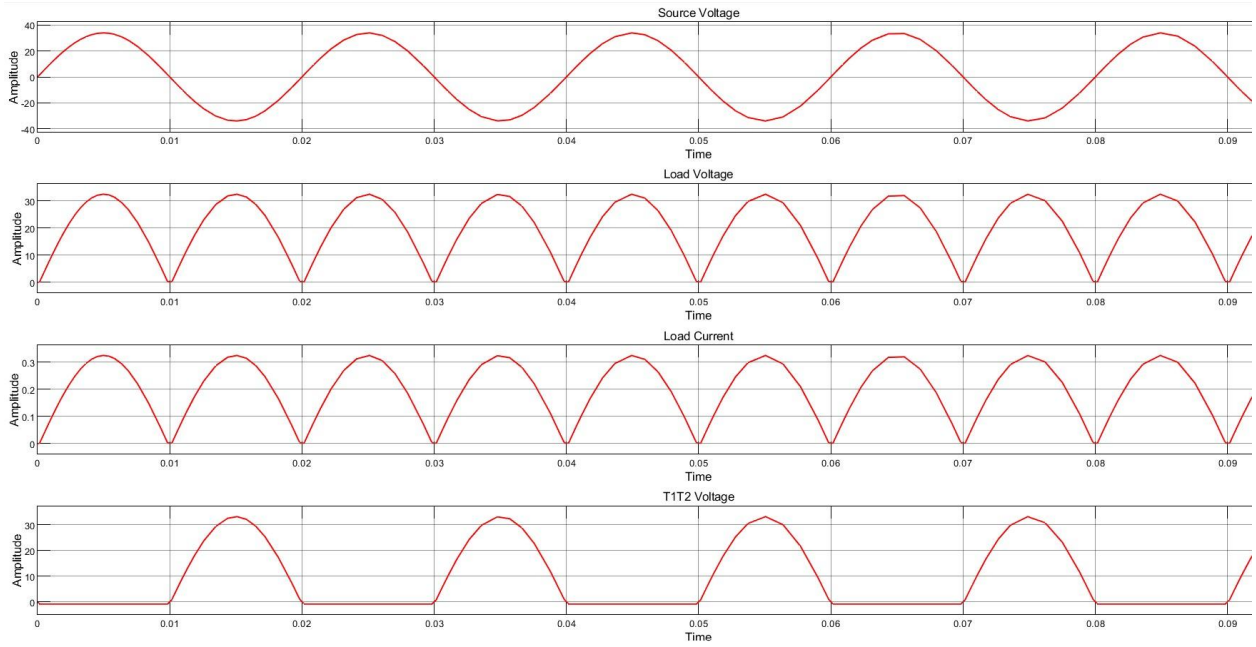
Vrms = 22.57V, Vavg = 19.96V



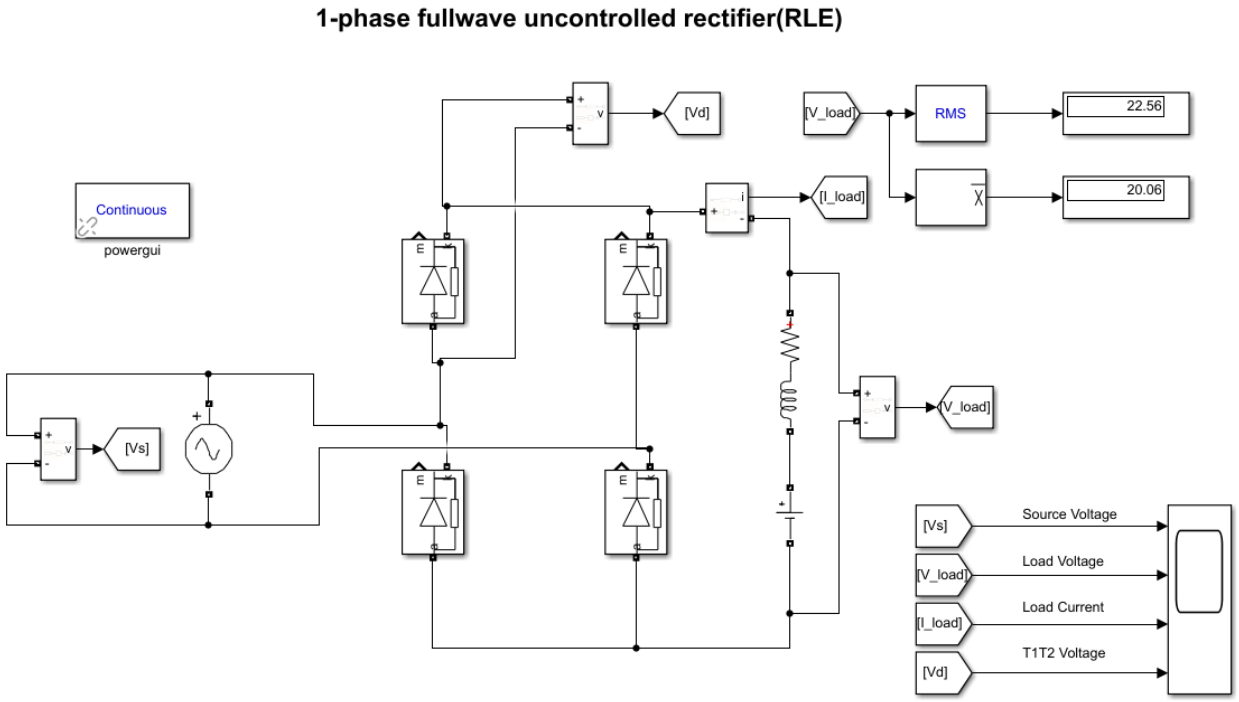
5. Single phase full wave uncontrolled rectifier RL load(100 ohms, 150uH)



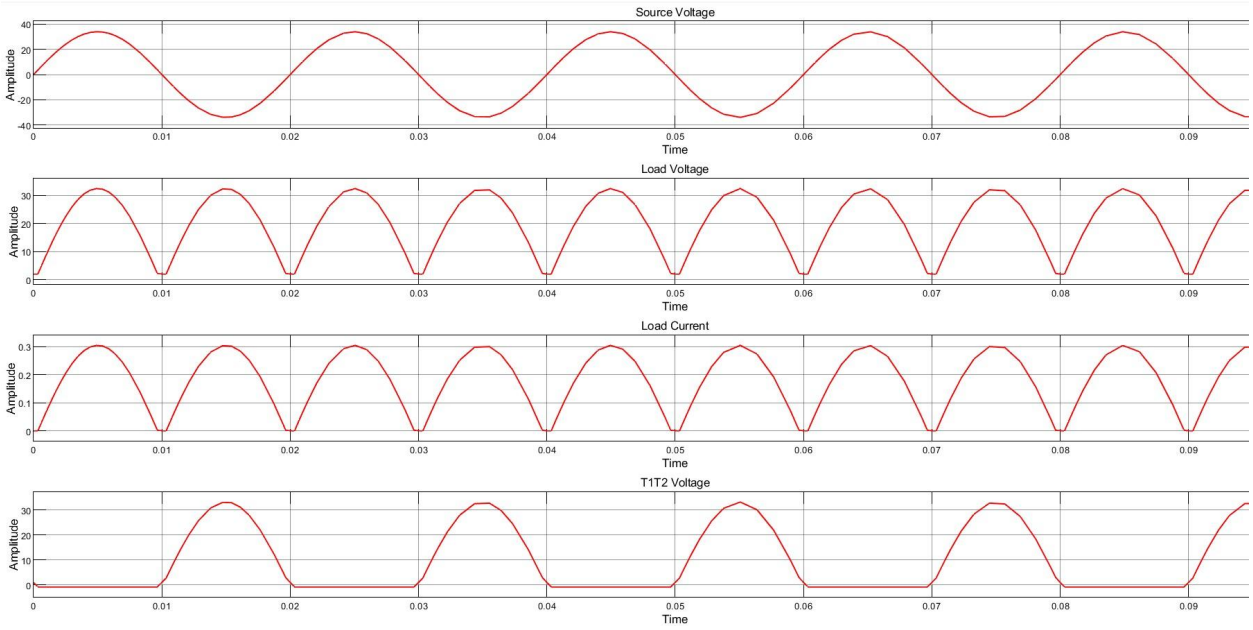
Vrms = 22.57V, Vavg = 19.95V



6. Single phase full wave uncontrolled rectifier RLE load(100 ohms, 150uH, 2V)



Vrms = 22.56V, Vavg = 20.06V

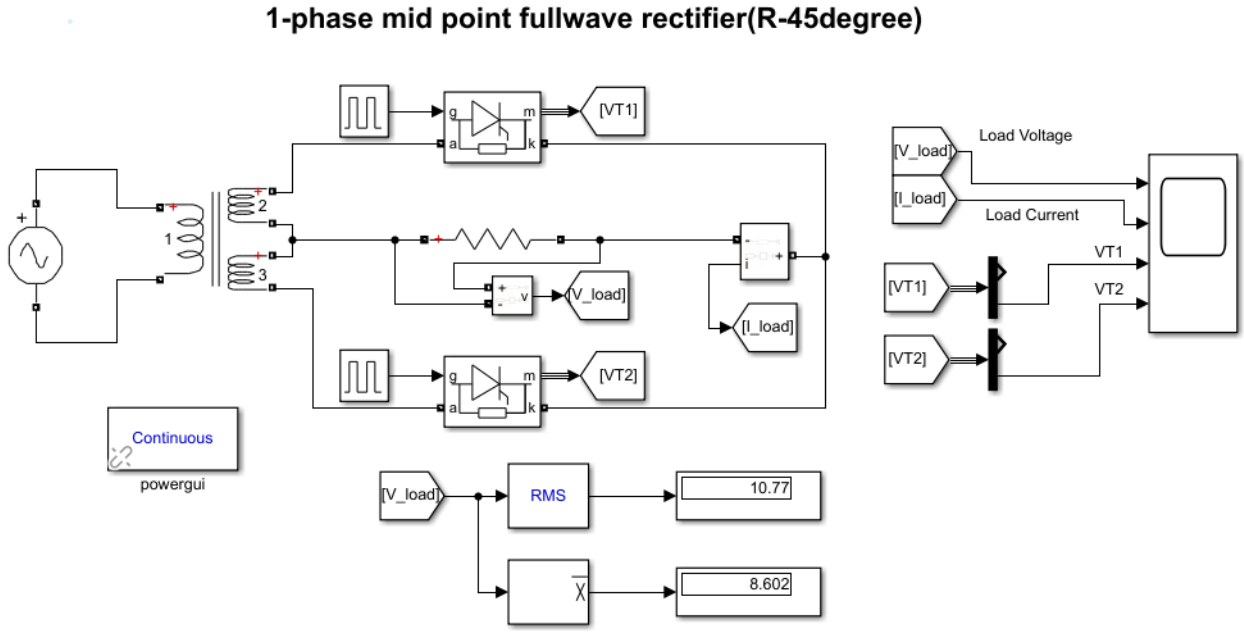


Uncontrolled Full wave rectifier table:

Components	Output Voltage (Vd)	
	Practicall y	Theoretical ly
R	22.56	21.645

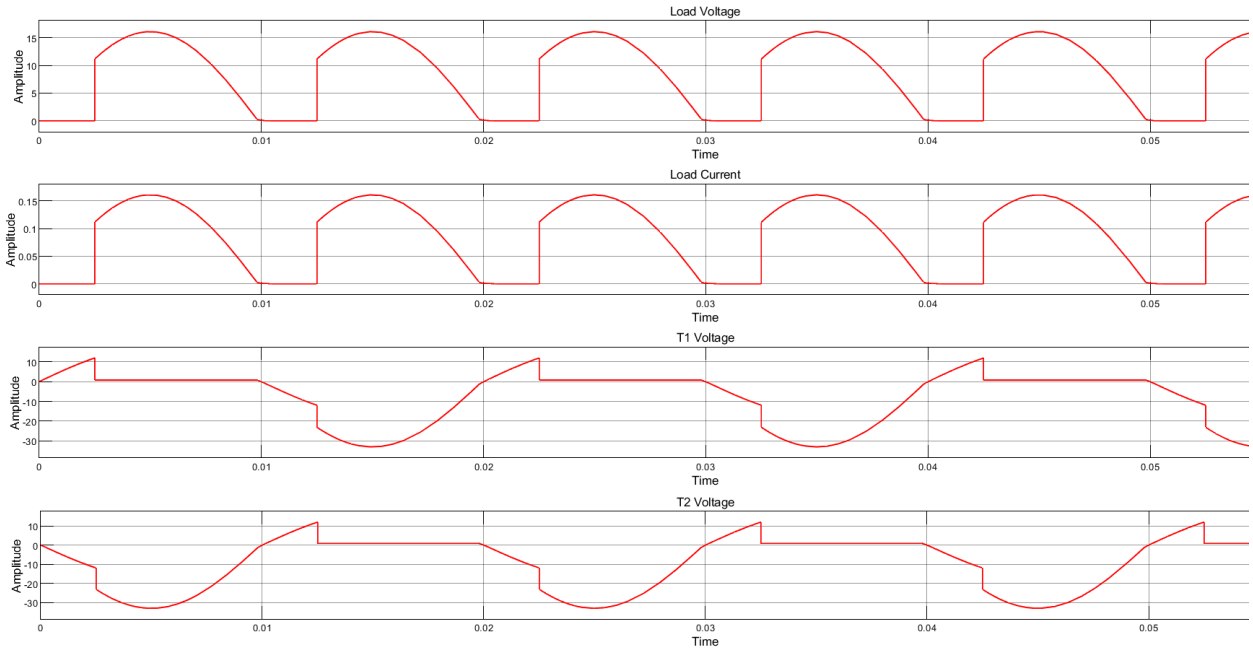
RL	**22.57**	**21.645**
RLE	**22.57**	**21.645**

7. Single phase mid point full wave rectifier R load(100 ohms)



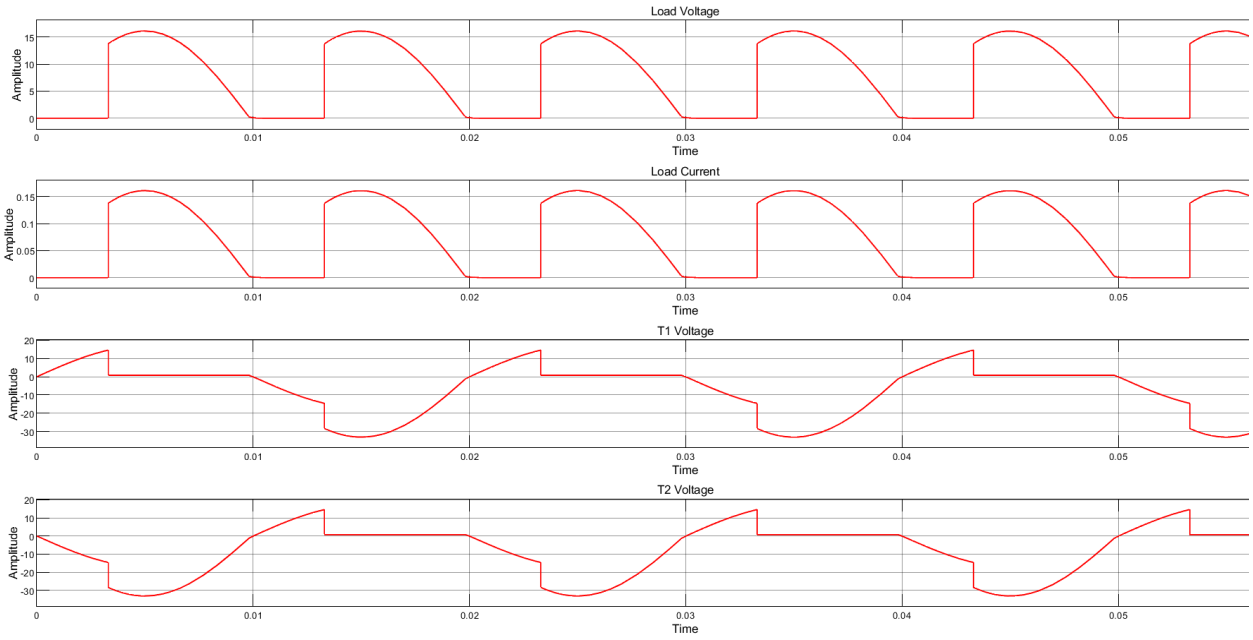
7(a) α = 45°

Vrms = 10.77V, Vavg = 8.6V

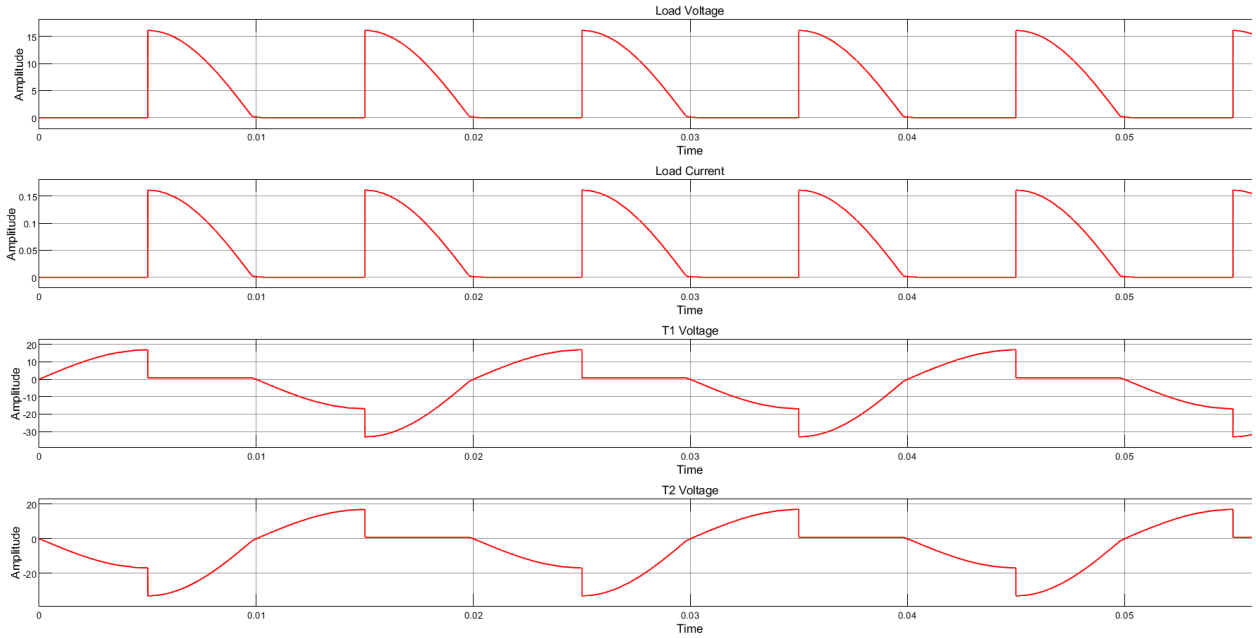


7(b) α = 60°

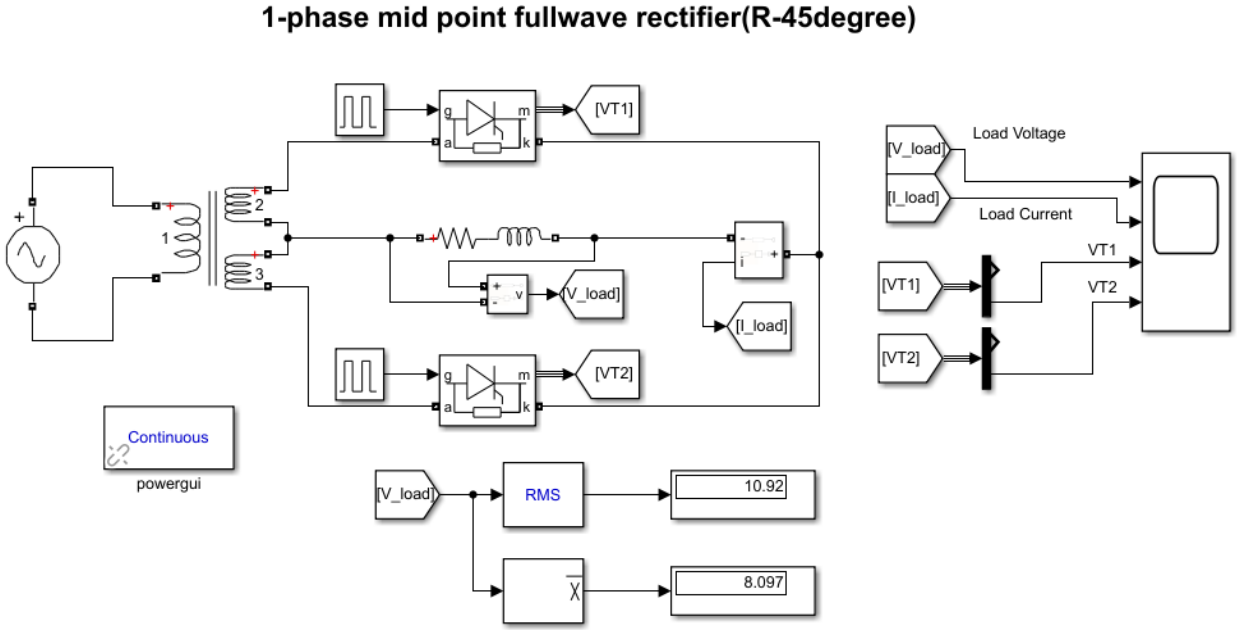
Vrms = 10.17V, Vavg = 7.59V



7(c) α = 90°
Vrms = 7.96V, Vavg = 4.96V

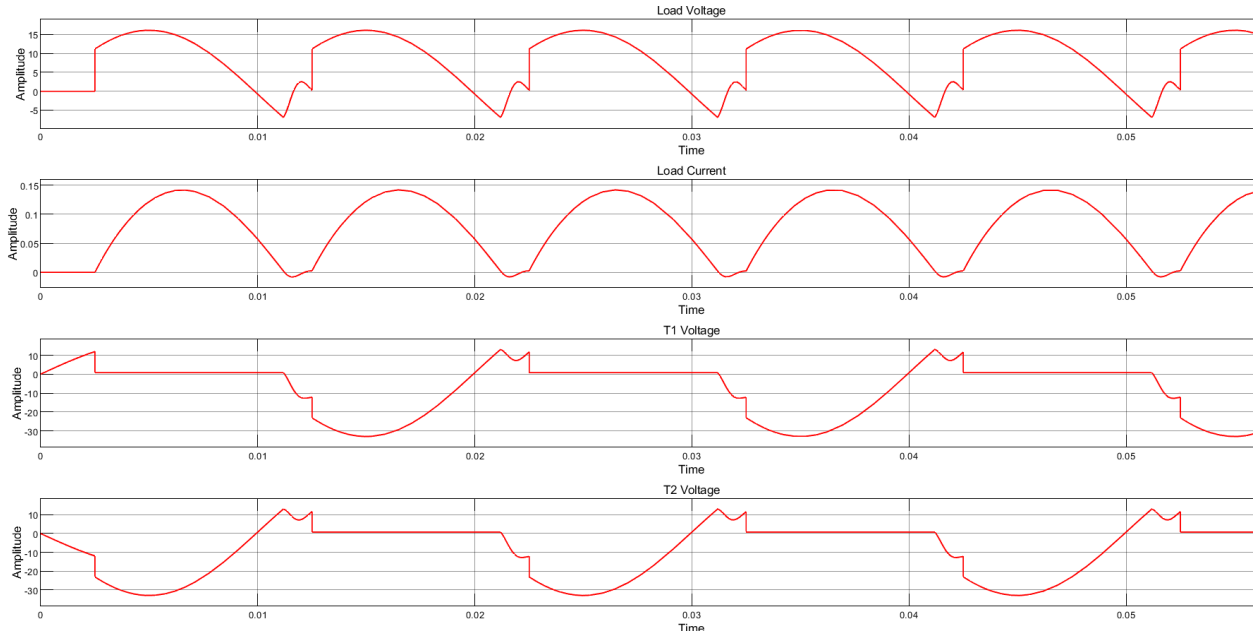


8. Single phase mid point full wave rectifier RL load(100 ohms, 150mH)



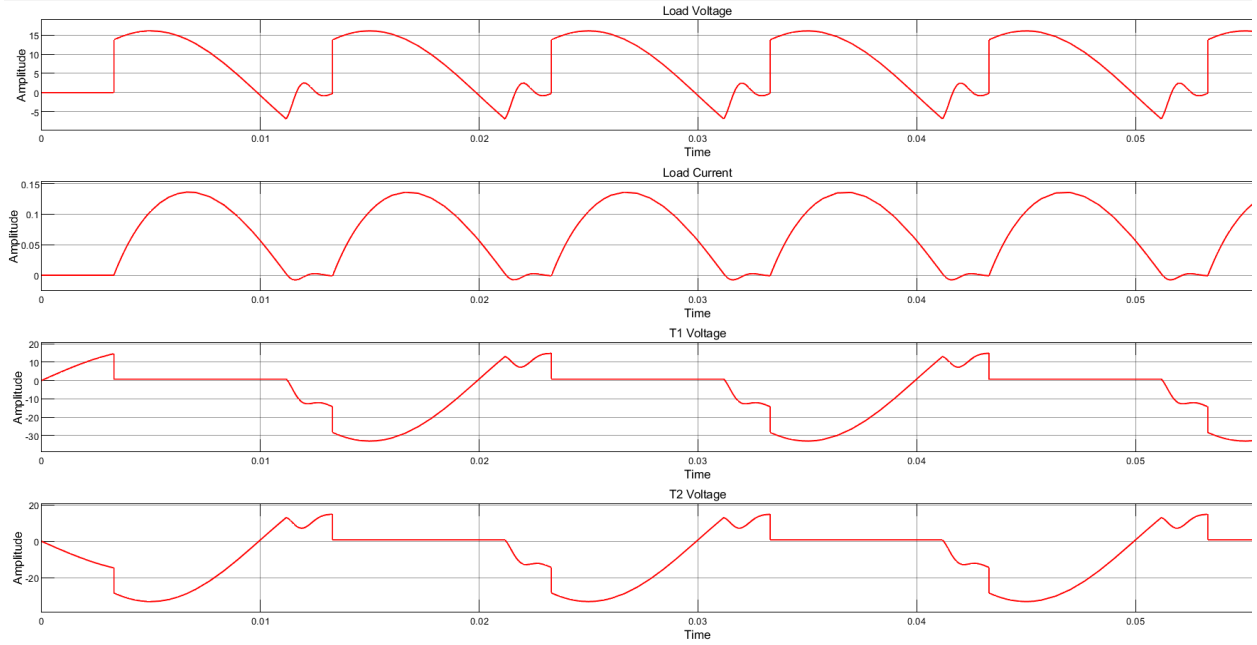
8(a) α = 45°

Vrms = 10.92V, Vavg = 8.097V



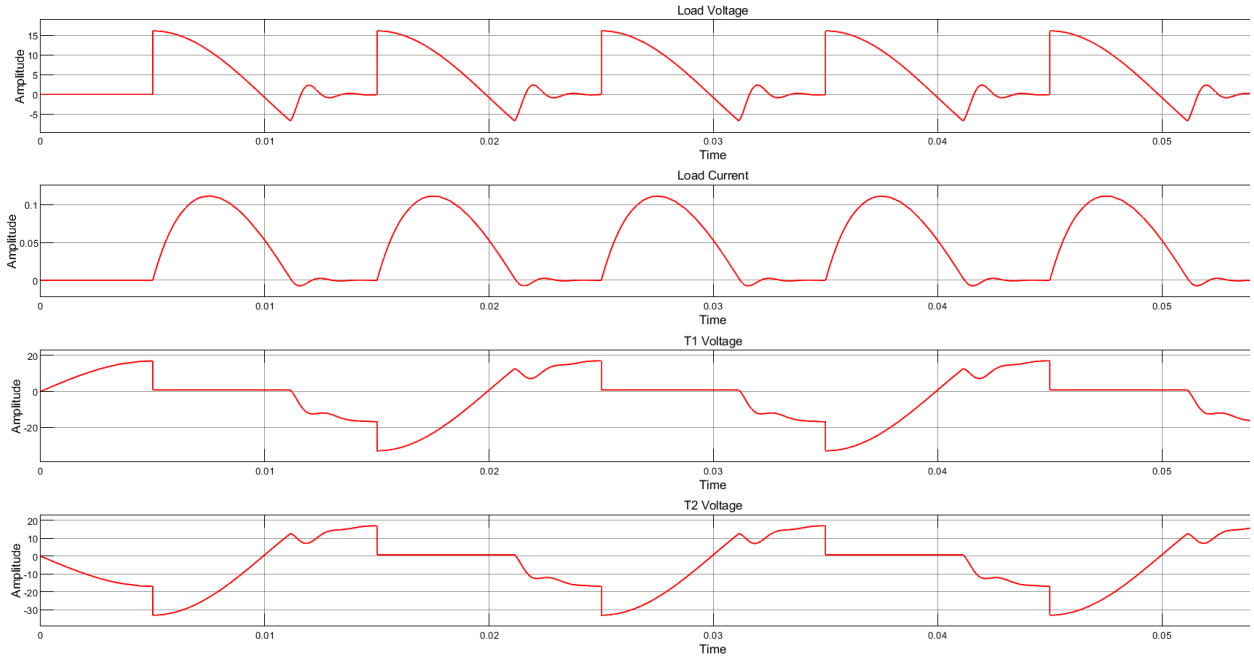
8(b) α = 60°

Vrms = 10.35V, Vavg = 7.035V



8(c) α = 90°

Vrms = 8.149V, Vavg = 4.48V



Calculation Table

	Uncontrolled	Controlled	Mid-Point
Average output voltage	21.645V	15.31V	146.4225V

RMS output voltage	**24.042V**	**24.04V**	**162.634V**
Peak load current	**0.2404A**	**0.24A**	**1.626A**
Average load current	**0.21645 A**	**34V**	**0.146A**
Peak inverter voltage	**34V**	**0.15A**	**230V**
Power delivered to load	**7.357W**	**5.77W**	**23.744W**
Ripple voltage	**10.462V**	**10.46V**	**70.771V**
Ripple factor	**0.482**	**0.482**	**0.482**
Form factor	**1.11**	**1.57**	**1.11**