END TERM PROJECT REPORT

Yaduraj Singh Tomar

231040124

Objective : To Implement MATLAB Model of 3 – Phase 15 Level Binary (1:2:4) cascaded Multilevel inverter and use phase disposition (PD) Multi-carrier PWM Technique to control Binary cascaded MLI

Vdc1=100V

Vdc2=200V

Vdc4=400V

Model – Circuit Diagram

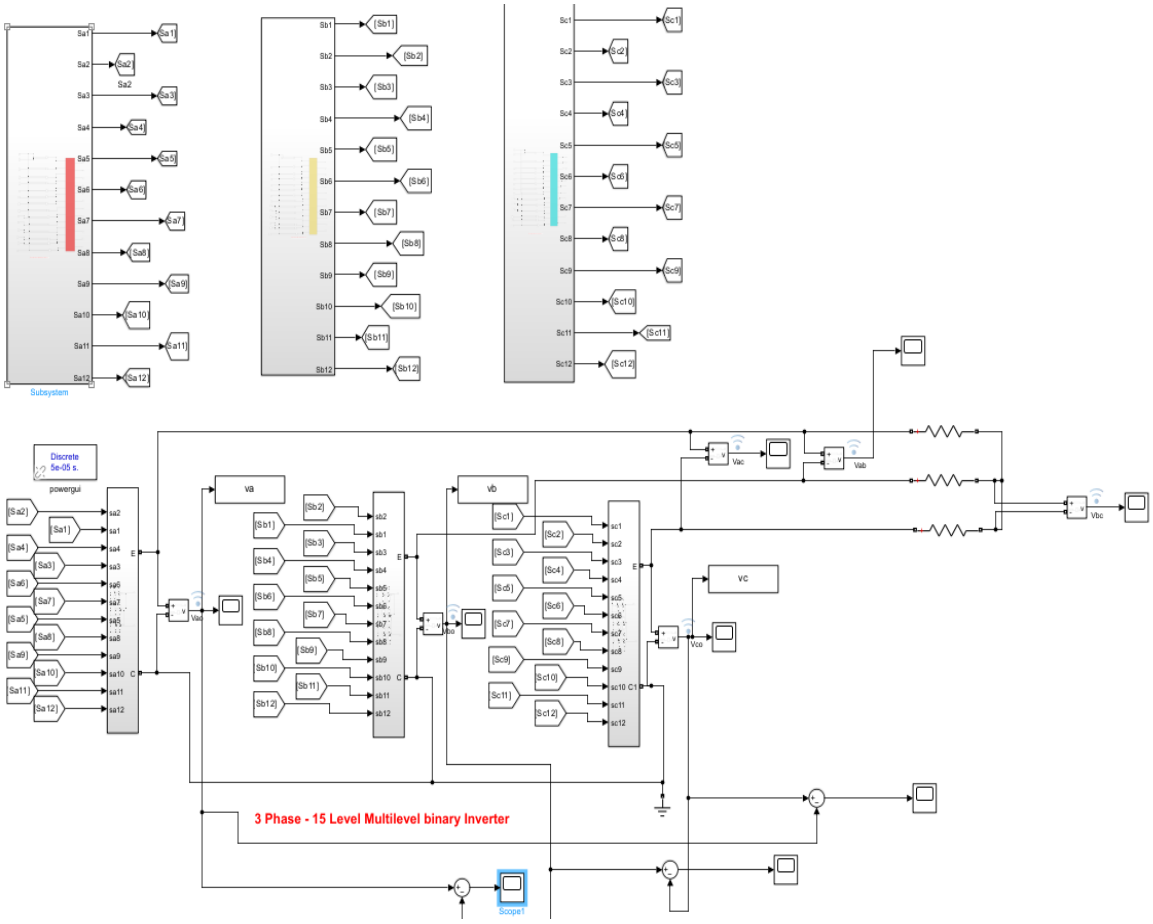


Fig1 : 3 – Phase 15 Level Binary (1:2:4) cascaded Multilevel inverter

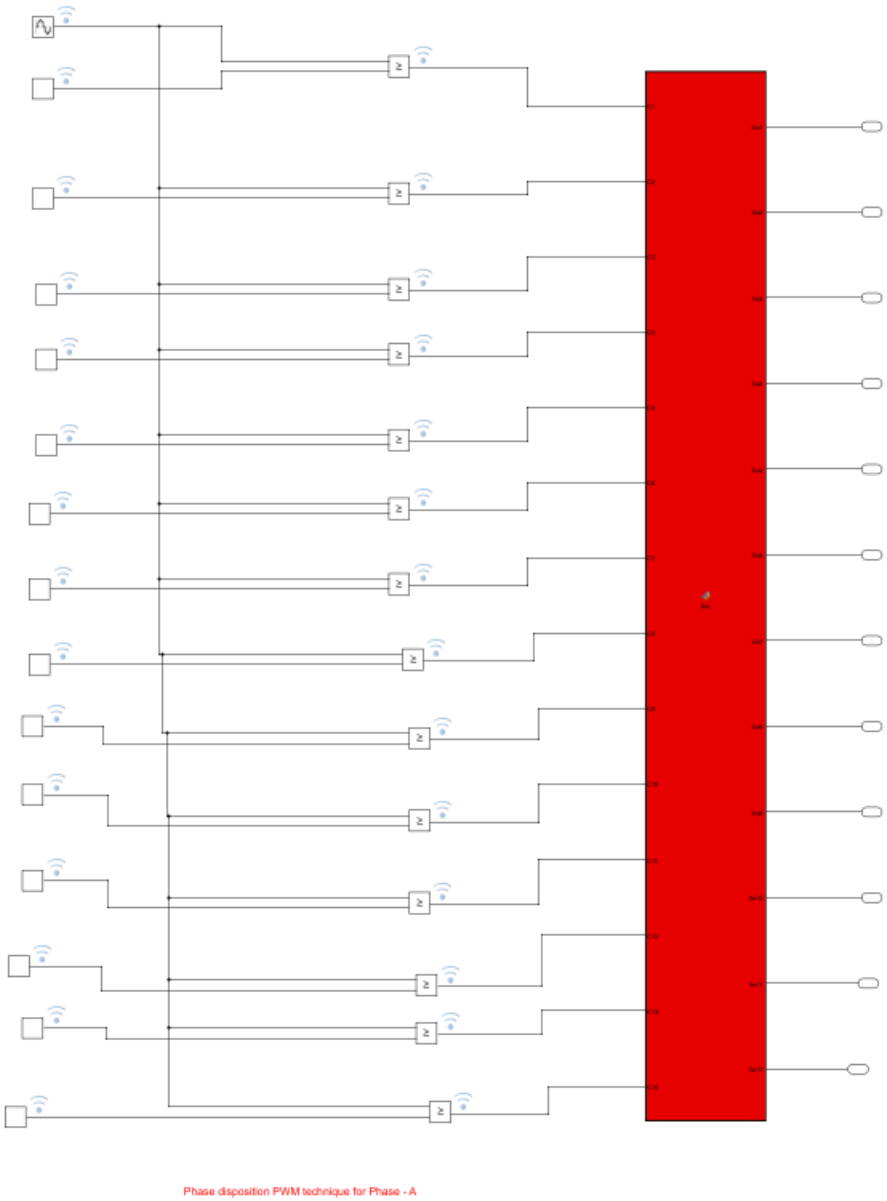


Fig2 : Phase Disposition Technique for Phase – A

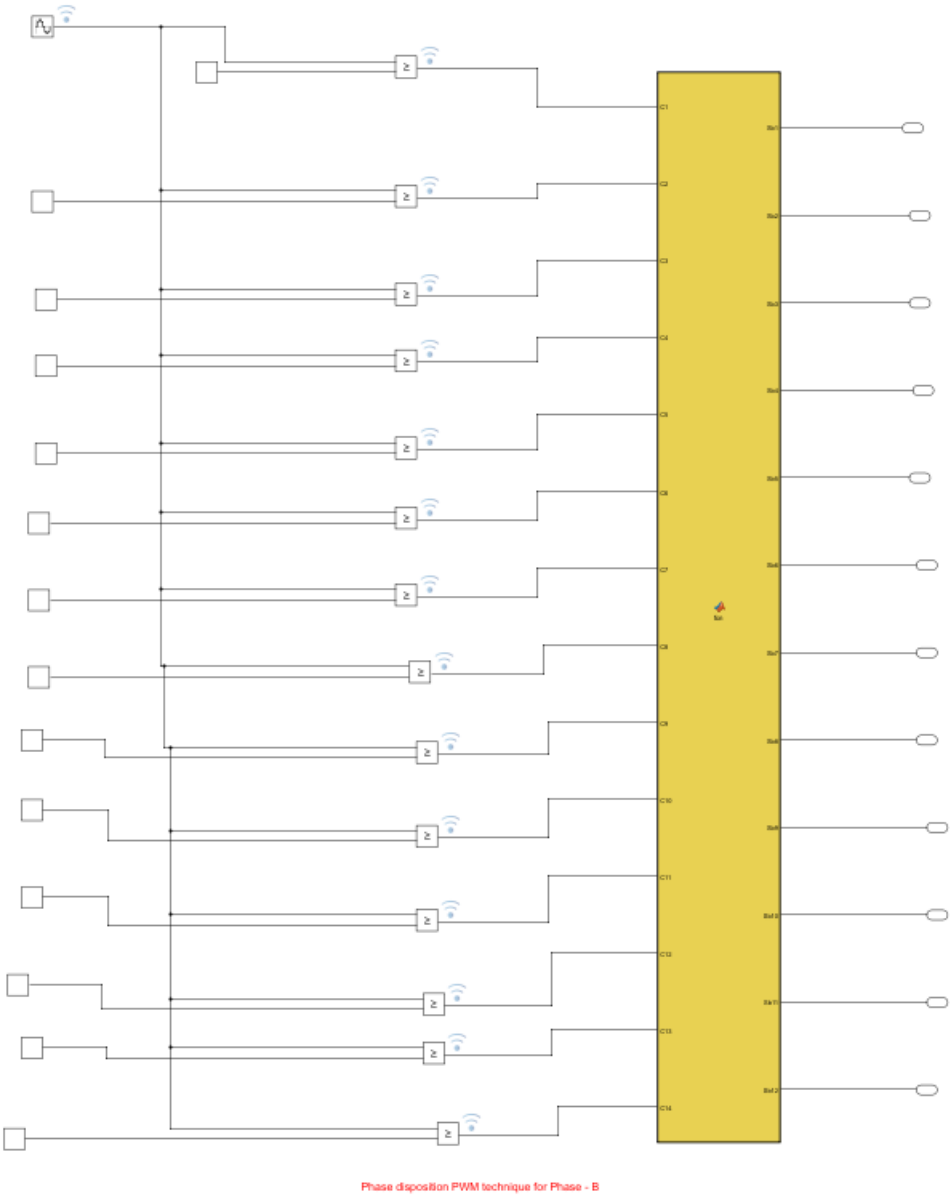


Fig3 : Phase Disposition Technique for Phase – B

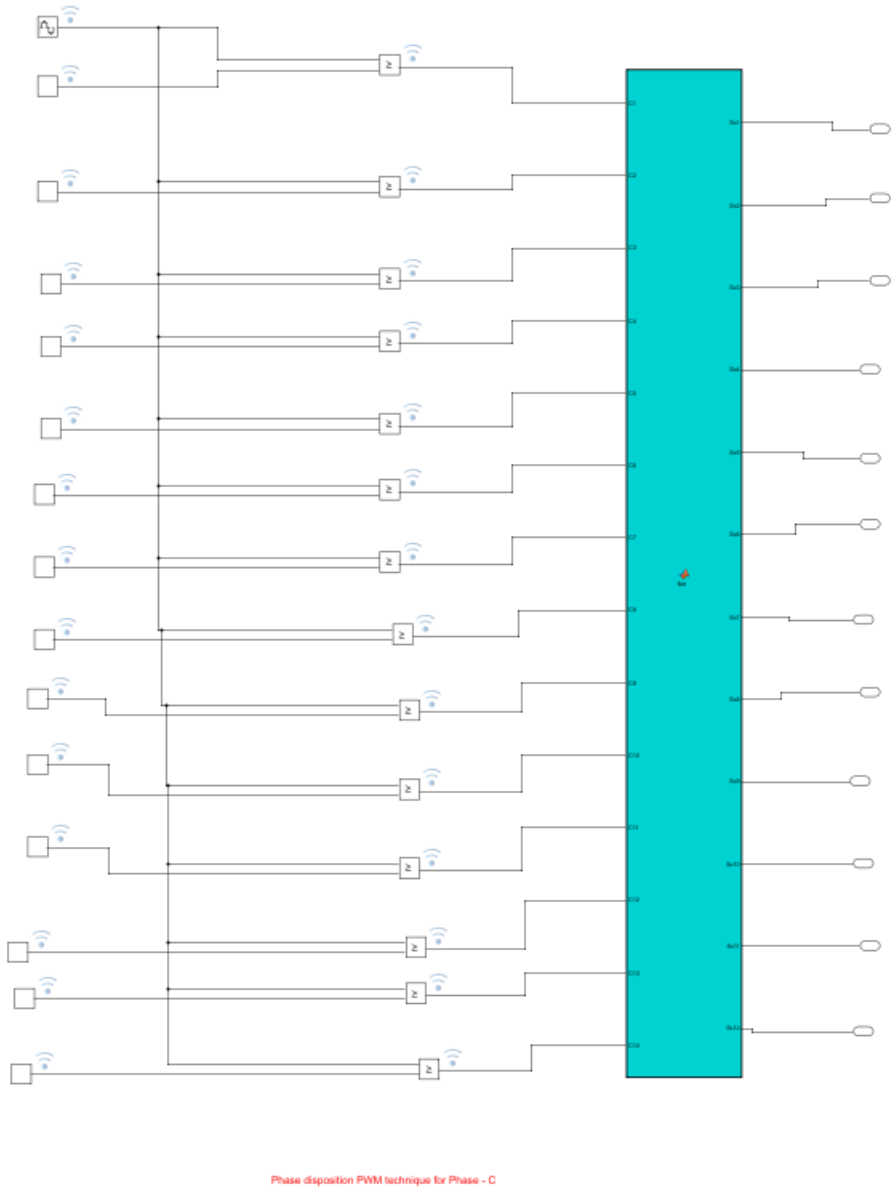


Fig4: Phase Disposition Technique for Phase – C

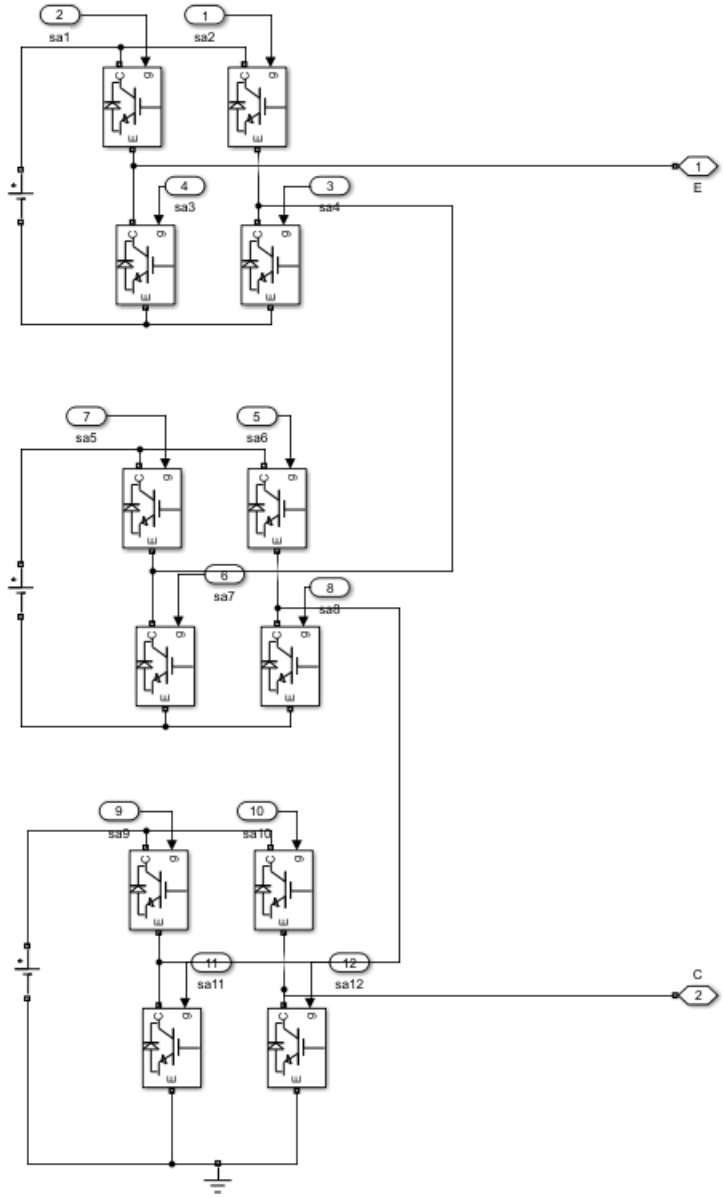


Fig 5 : Leg A of Cascaded H- Bridge MLI

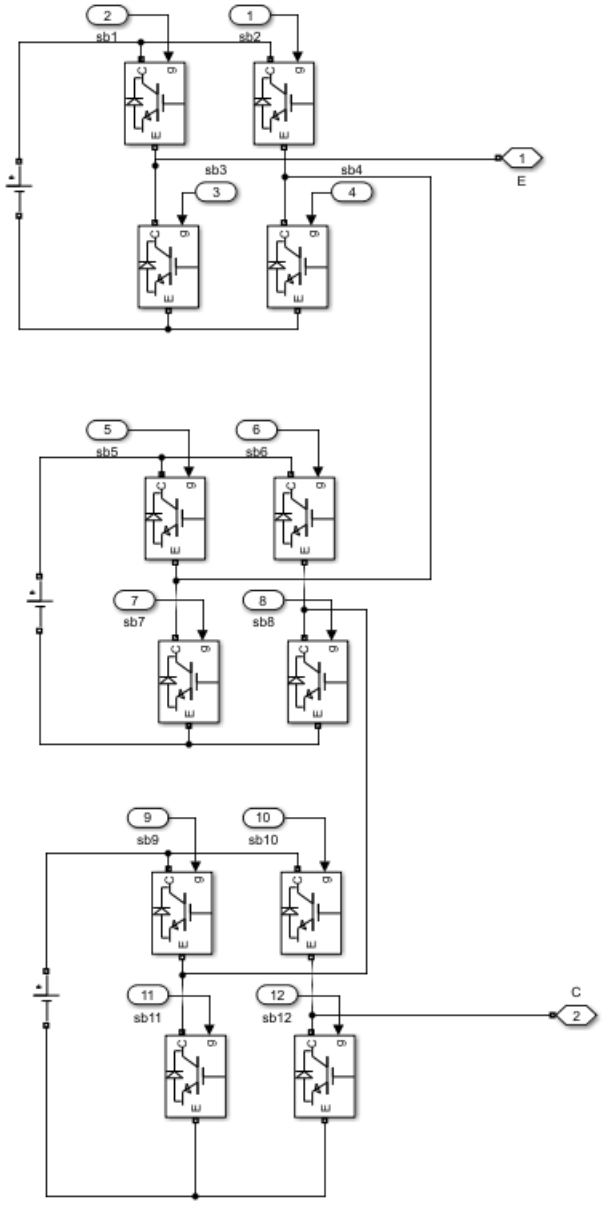


Fig 6 : Leg B of Cascaded H- Bridge MLI

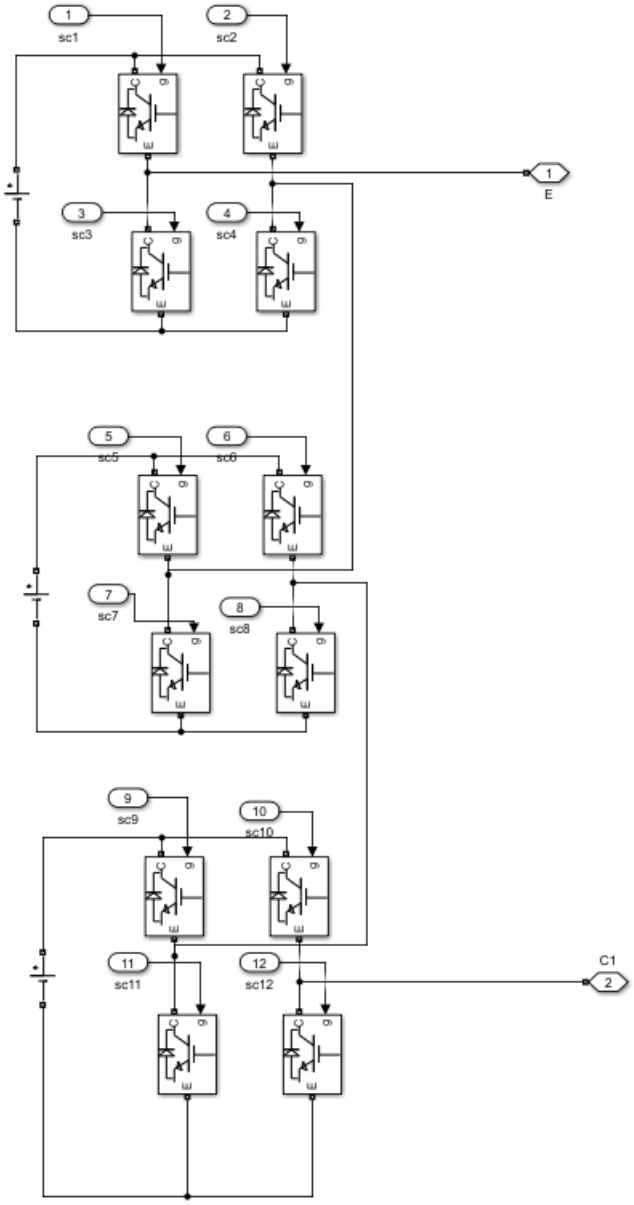
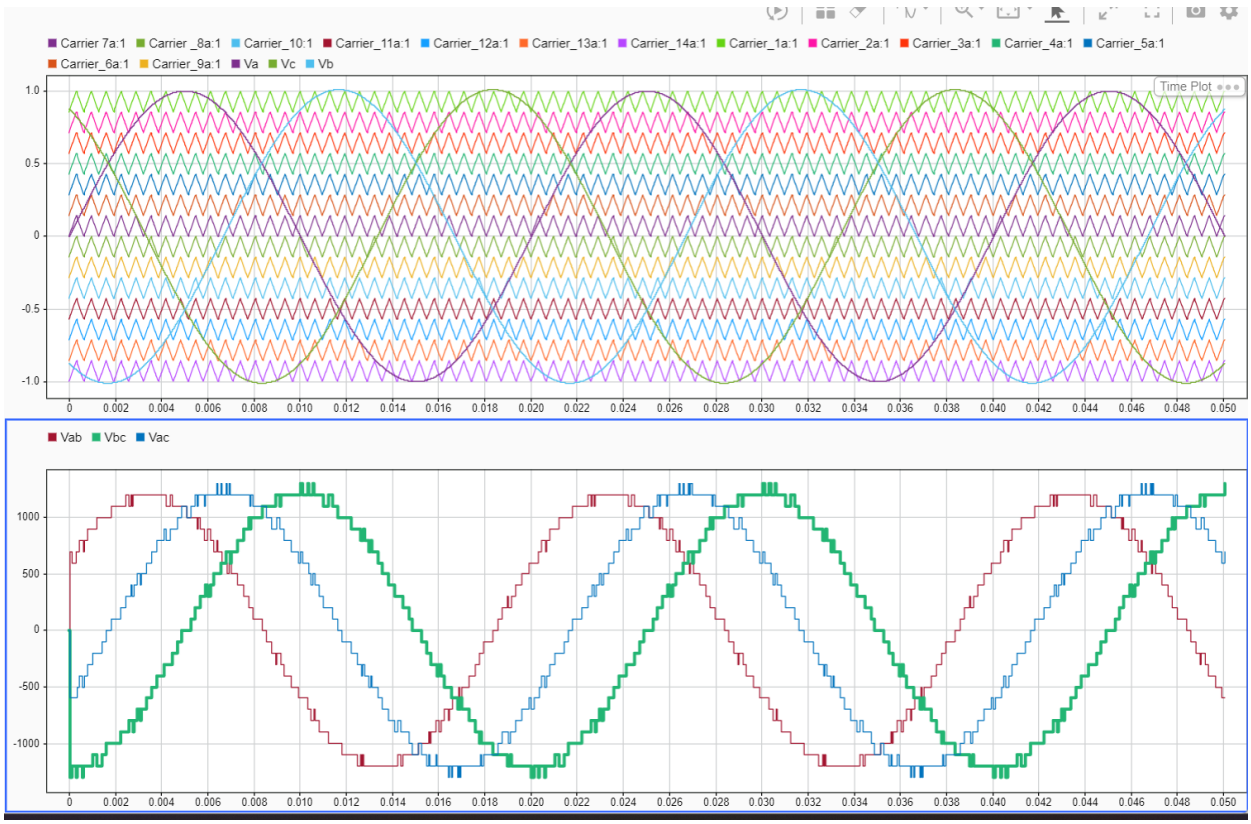
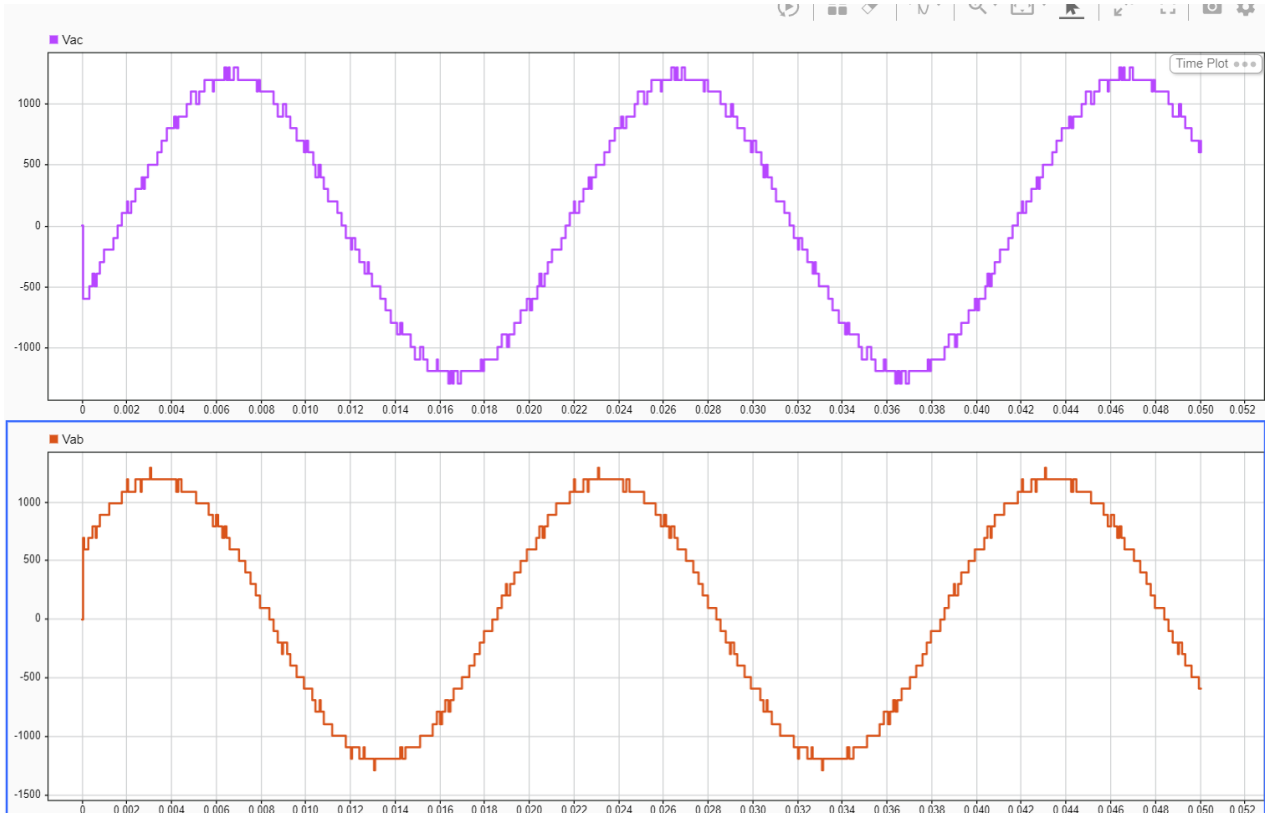


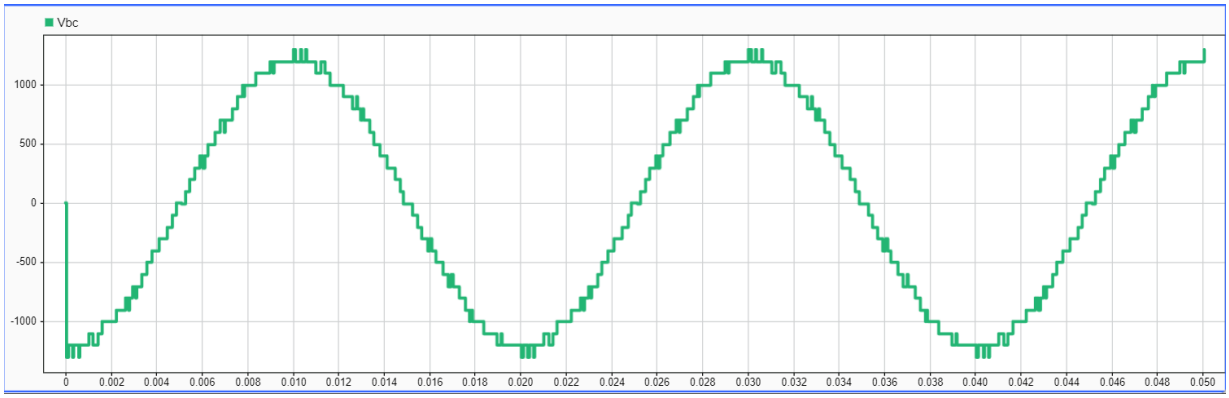
Fig 7 : Leg C of Cascaded H- Bridge MLI

Phase Disposition Modulation Technique :

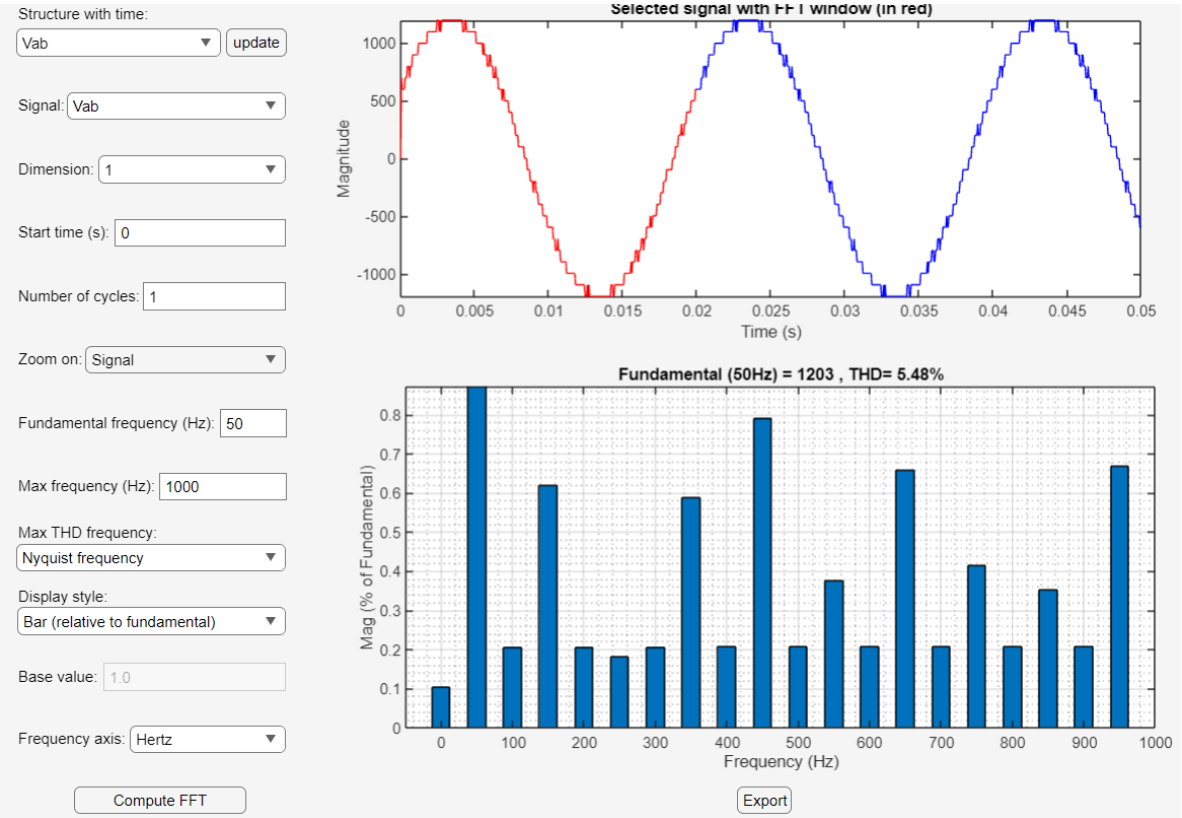


Line Voltage Waveform :

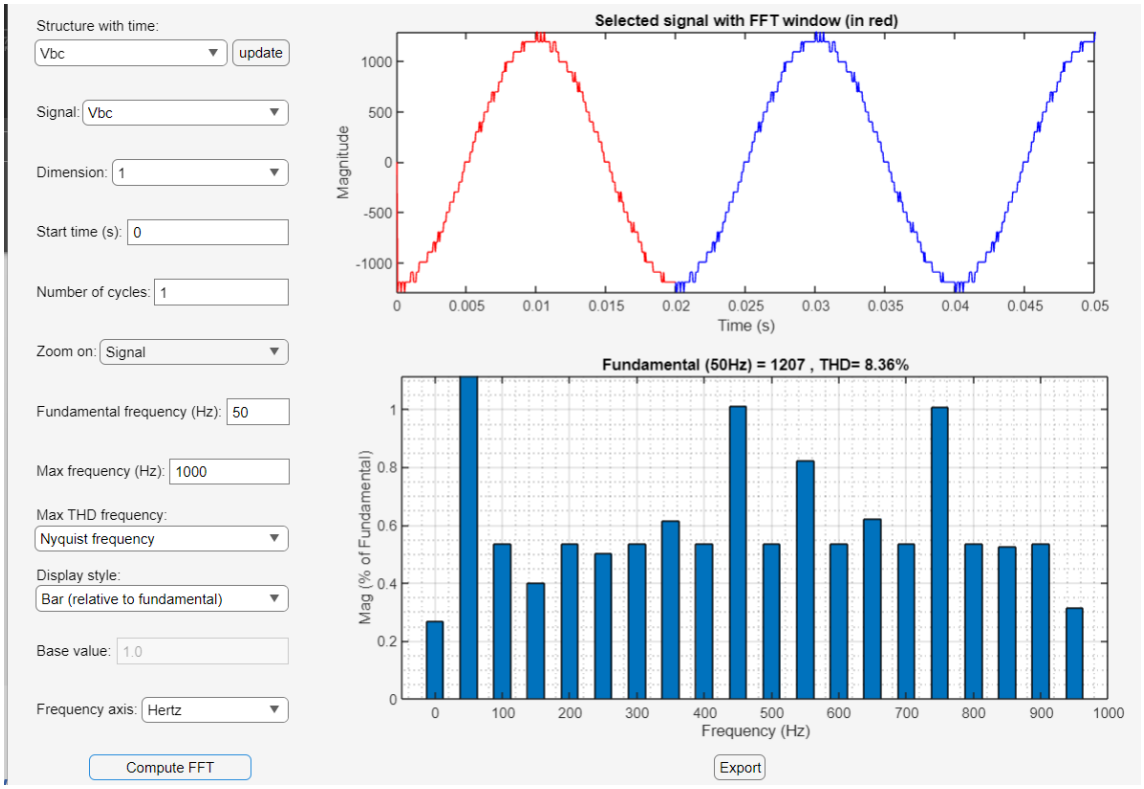




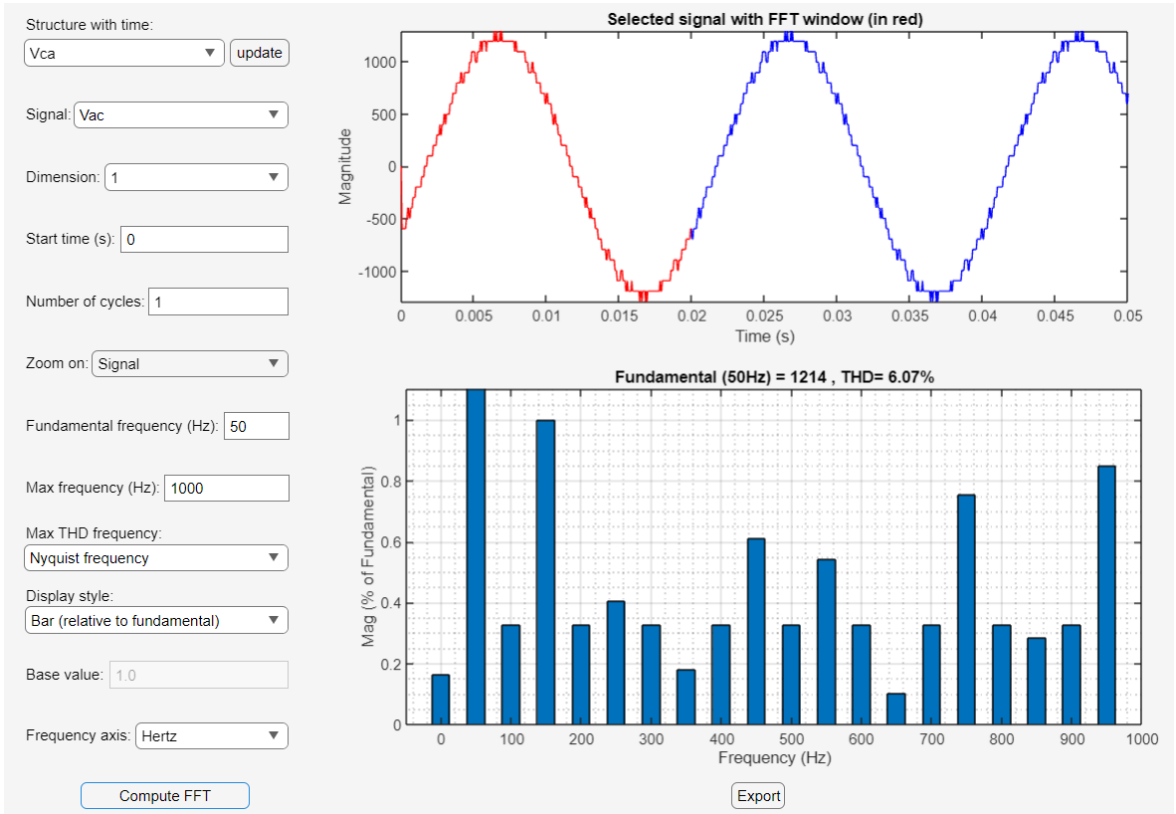
FFT Of Line Voltage (Vab):



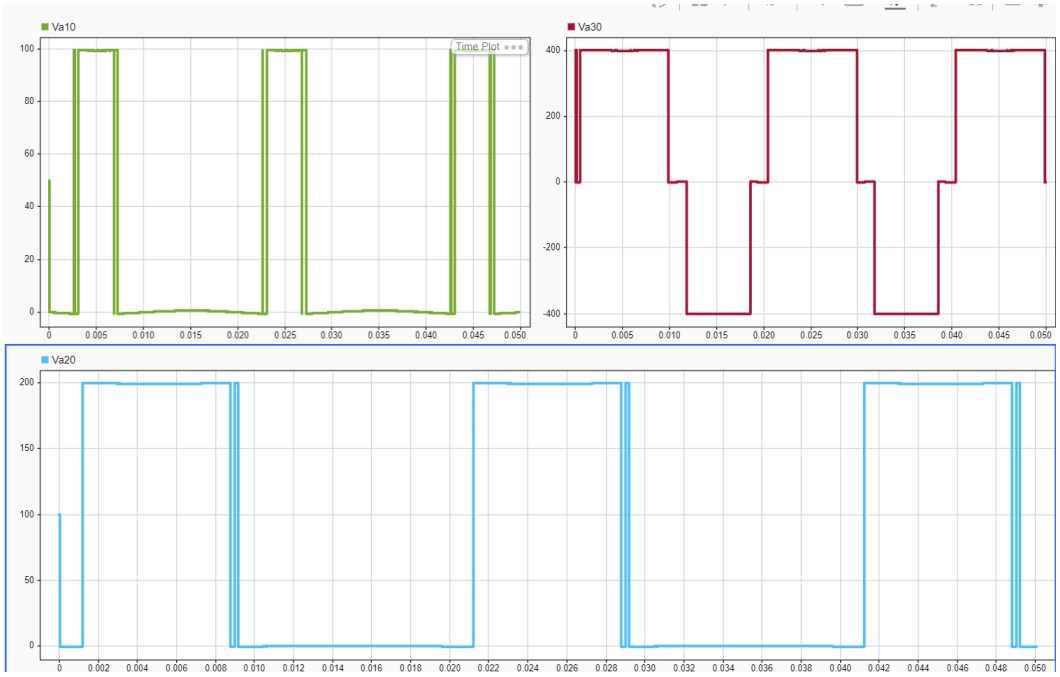
FFT Of Line Voltage (Vbc):

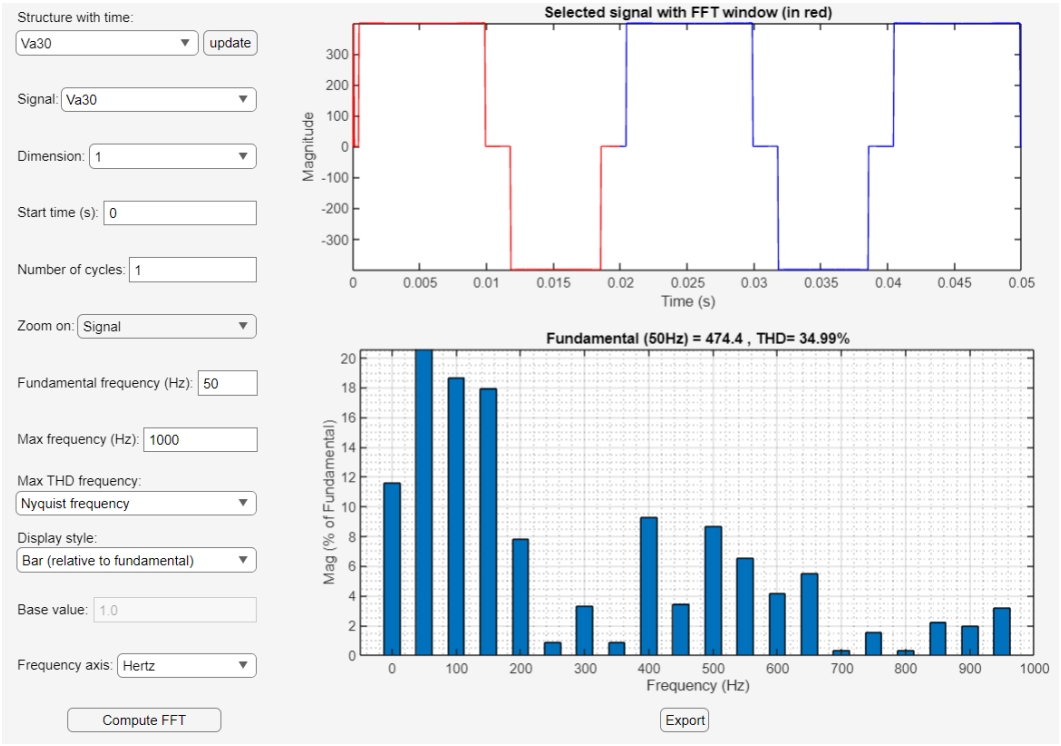


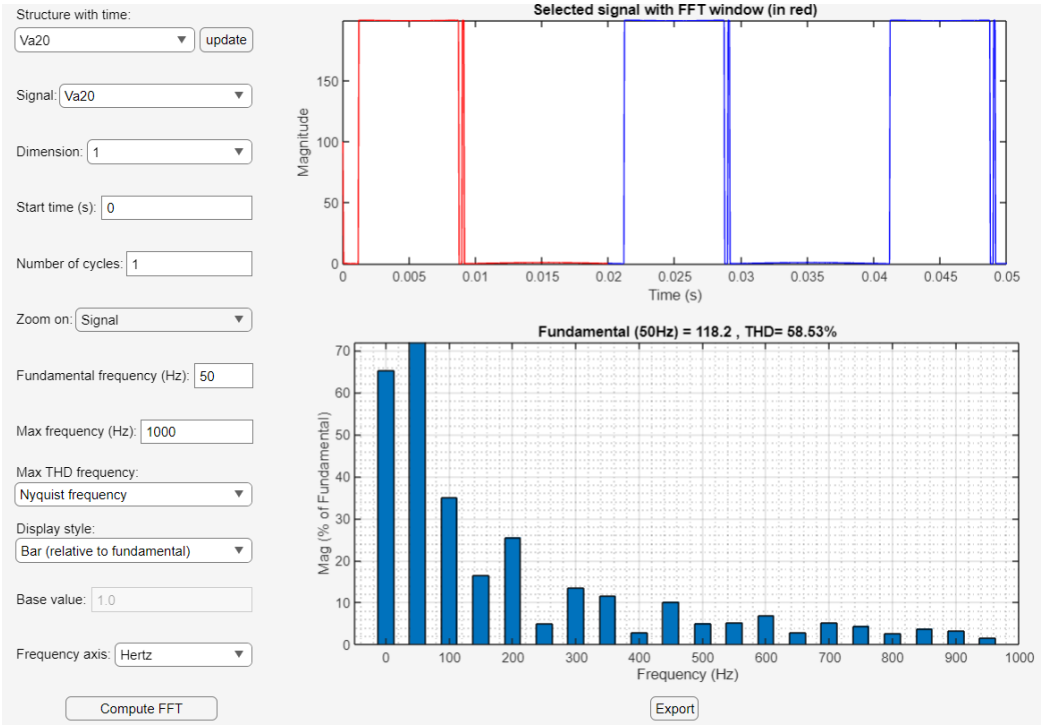
FFT Of Line Voltage (Vac):

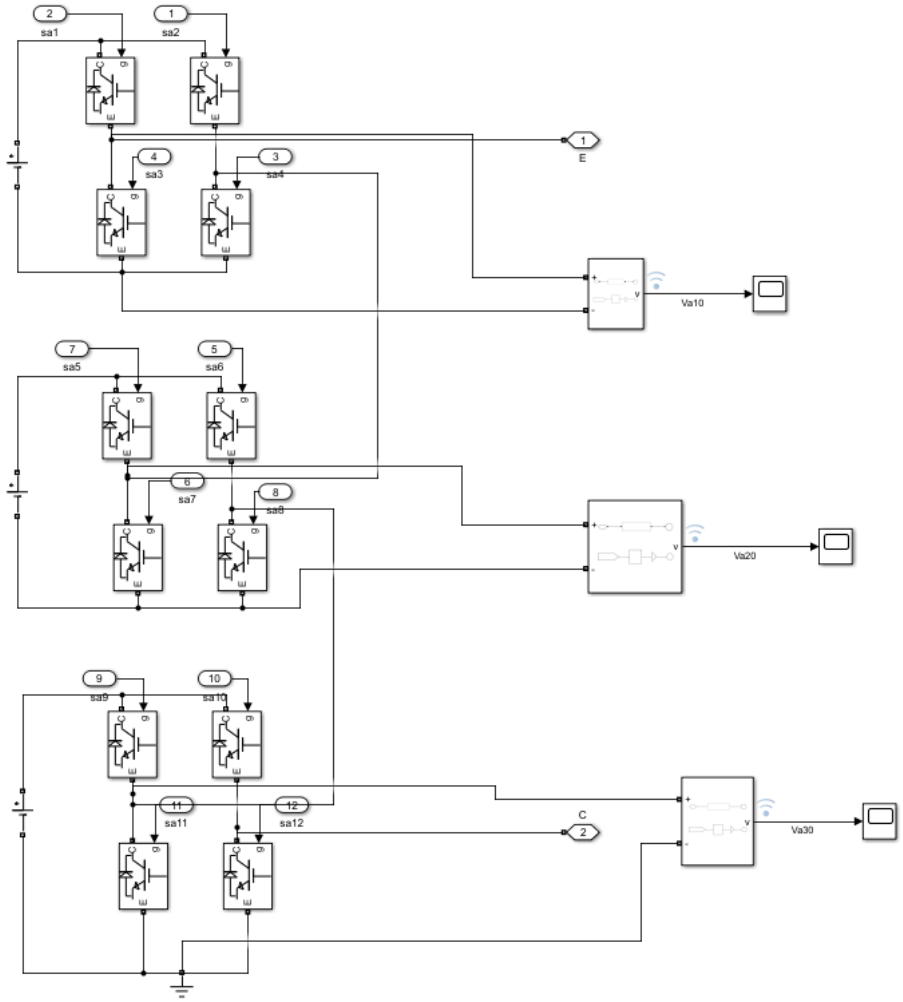


Pole Voltages and FFT of Leg A

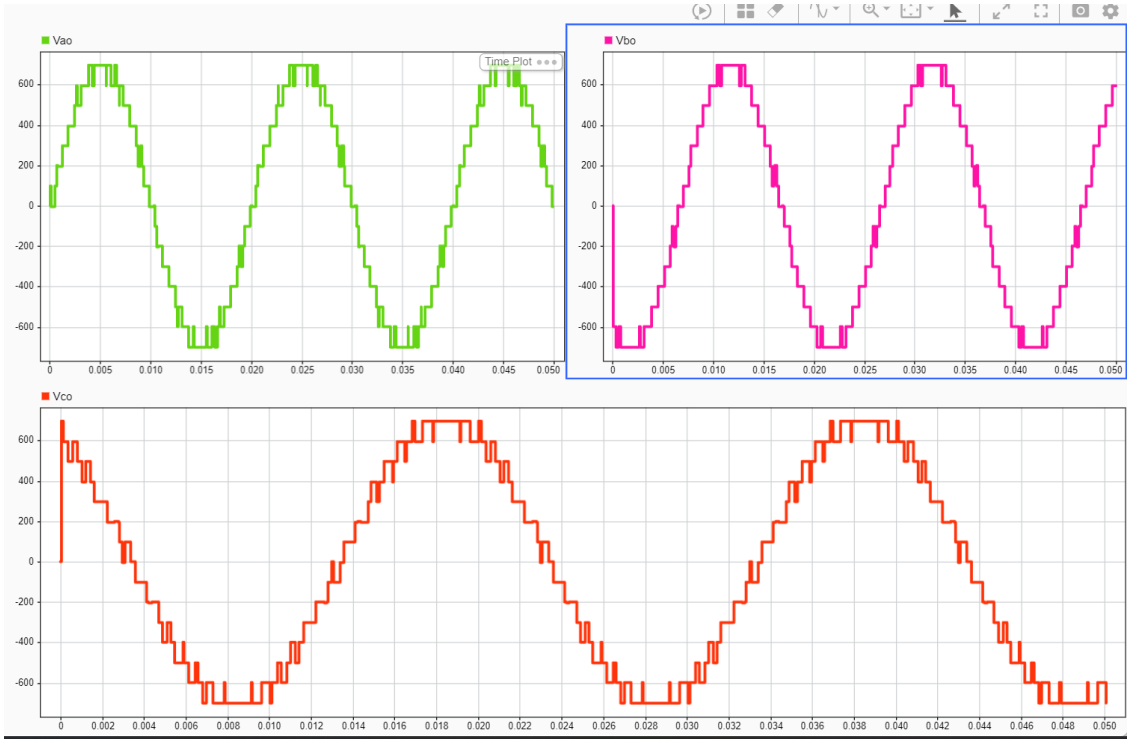





Structure with time:
Va20
update
Signal: Va20
Dimension: 1
Start time (s): 0
Number of cycles: 1
Zoom on: Signal
Fundamental frequency (Hz): 50
Max frequency (Hz): 1000
Max THD frequency:
Nyquist frequency
Display style:
Bar (relative to fundamental)
Base value: 1.0
Frequency axis: Hertz
Compute FFT
Selected signal with FFT window (in red)
Magnitude
Time (s)
Fundamental (50Hz) = 118.2 , THD= 58.53%
Mag (% of Fundamental)
Frequency (Hz)
Export


sa1
sa2
sa3
sa4
sa5
sa6
sa7
sa8
sa9
sa10
sa11
sa12
E
C
Va10
Va20
Va30

Pole Voltage Waveform for15 level MLI (Vao , Vbo, Vco) :



FFT Of Pole Voltage of 15 Level MLI (Vao , Vbo, Vco) :

Structure with time:
Vao update

Signal: Vao

Dimension: 1

Start time (s): 0

Number of cycles: 1

Zoom on: Signal

Fundamental frequency (Hz): 50

Max frequency (Hz): 1000

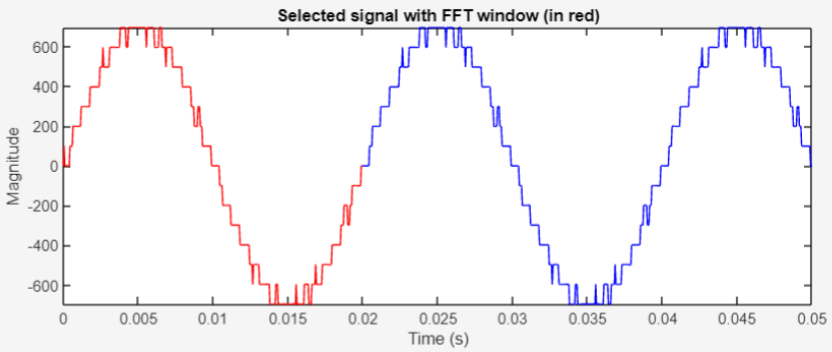
Max THD frequency:
Nyquist frequency

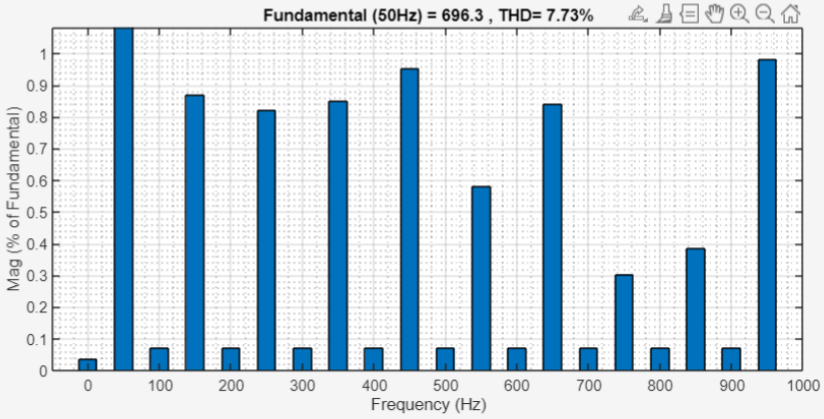
Display style:
Bar (relative to fundamental)

Base value: 1.0

Frequency axis: Hertz

Compute FFT





Export

Structure with time:
Vbo update

Signal: Vbo

Dimension: 1

Start time (s): 0

Number of cycles: 1

Zoom on: Signal

Fundamental frequency (Hz): 50

Max frequency (Hz): 1000

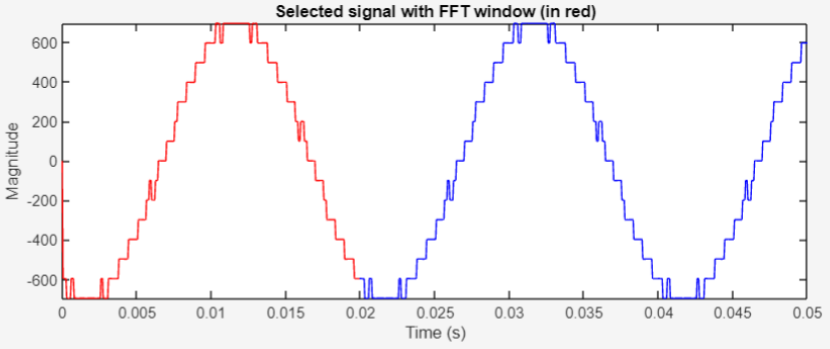
Max THD frequency:
Nyquist frequency

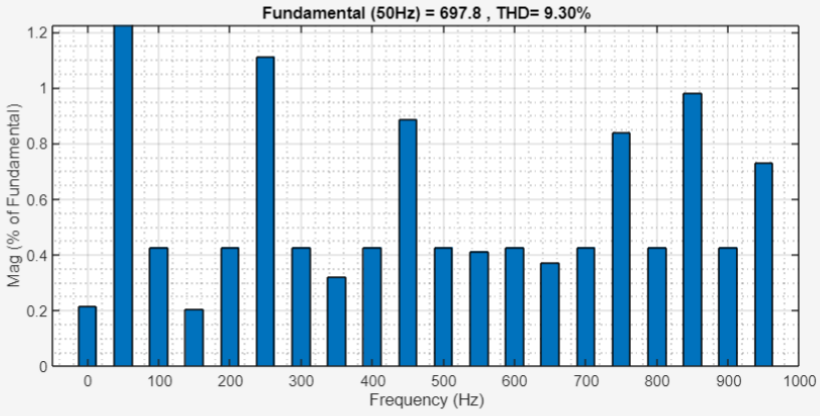
Display style:
Bar (relative to fundamental)

Base value: 1.0

Frequency axis: Hertz

Compute FFT





Export

Structure with time:

Vco | update

Signal: Vco

Dimension: 1

Start time (s): 0

Number of cycles: 1

Zoom on: Signal

Fundamental frequency (Hz): 50

Max frequency (Hz): 1000

Max THD frequency:

Nyquist frequency

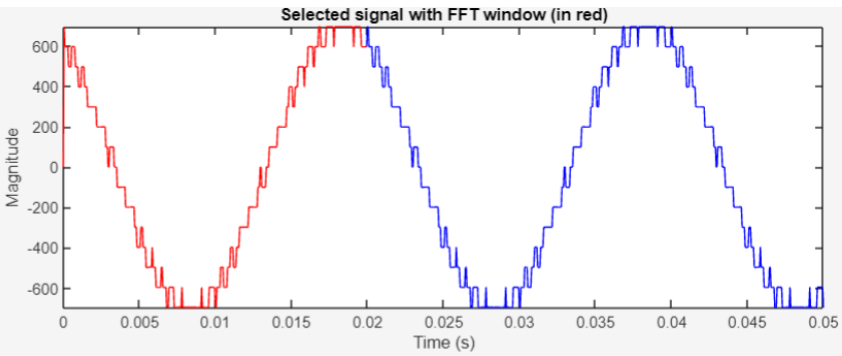
Display style:

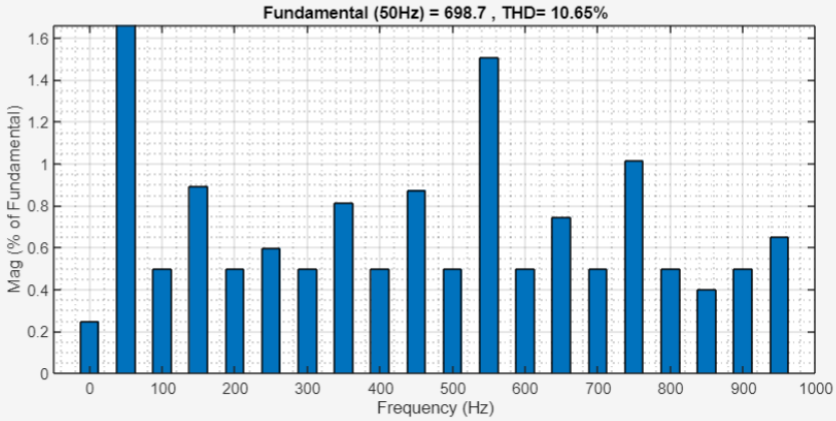
Bar (relative to fundamental)

Base value: 1.0

Frequency axis: Hertz

Compute FFT





Export

Observation :

1. Line Voltage

Line voltage- Vab (RMS) =1203 volt & THD=5.48%

Line voltage – Vbc (RMS) =1207 volt & THD=8.36%

Line voltage - Vac (RMS) =1214 volt & THD=6.07%

2. Pole Voltage

Pole Voltage – Vao = 696.3V & THD=7.73%

Pole Voltage – Vbo = 697.8V & THD=9.30%

Pole Voltage – Vco = 698.7V & THD=10.65%

3 . Advantages :

- Improved Output Quality: Multilevel inverters provide a closer approximation to a sinusoidal waveform compared to traditional two-level inverters.
- Reduced Harmonics: The stepped nature of the voltage levels helps in reducing harmonic content in the output waveform.
- Higher Voltage Capability: Multilevel inverters can produce higher voltage levels without requiring extremely high voltage-rated switches.