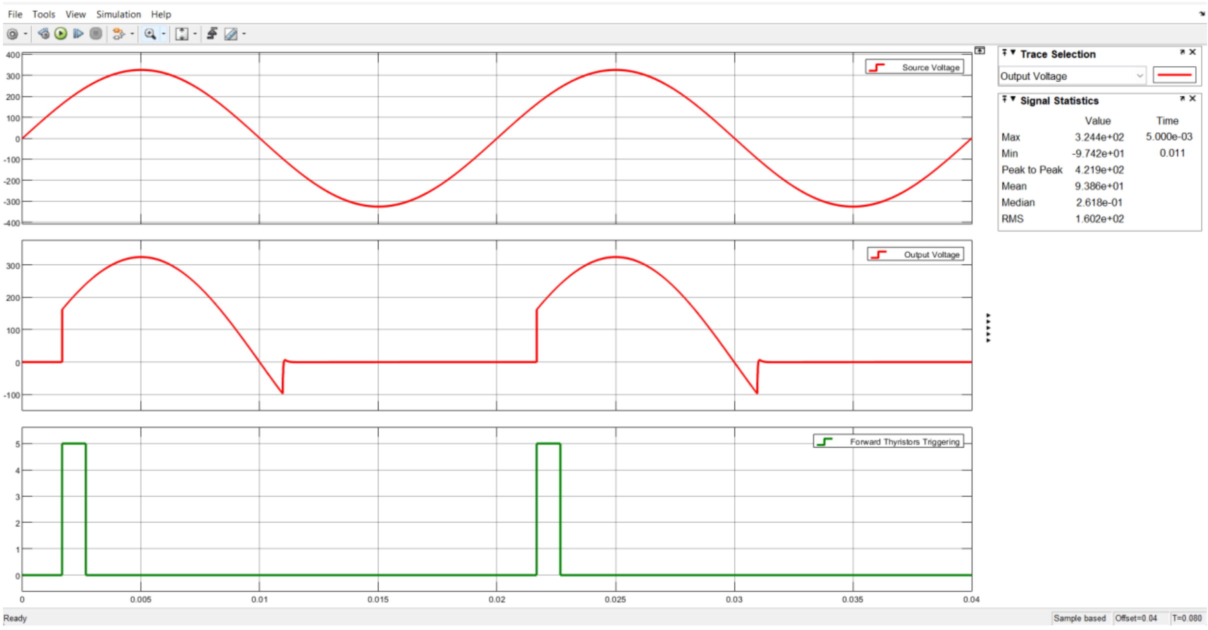
Praprara Owodeha-Ashaka

Power Electronics Lab 3

A. Single-Phase Half-Wave Controlled Rectifier

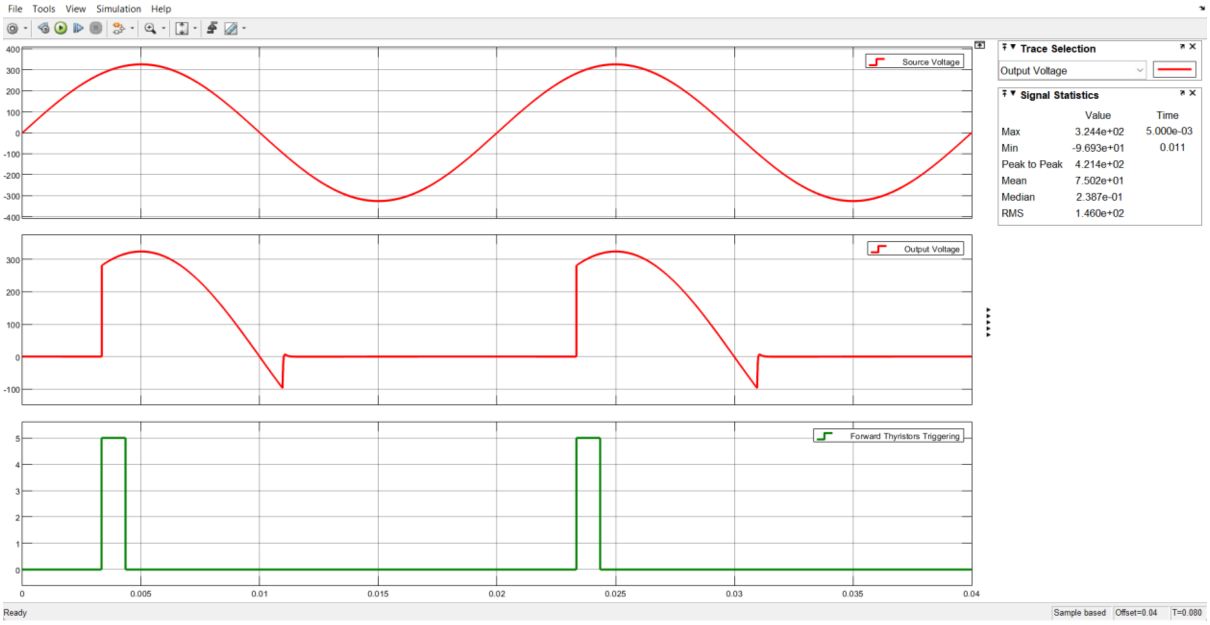
1. α=30°



Average voltage: 93.86 Volts

RMS voltage: 160.2 Volts

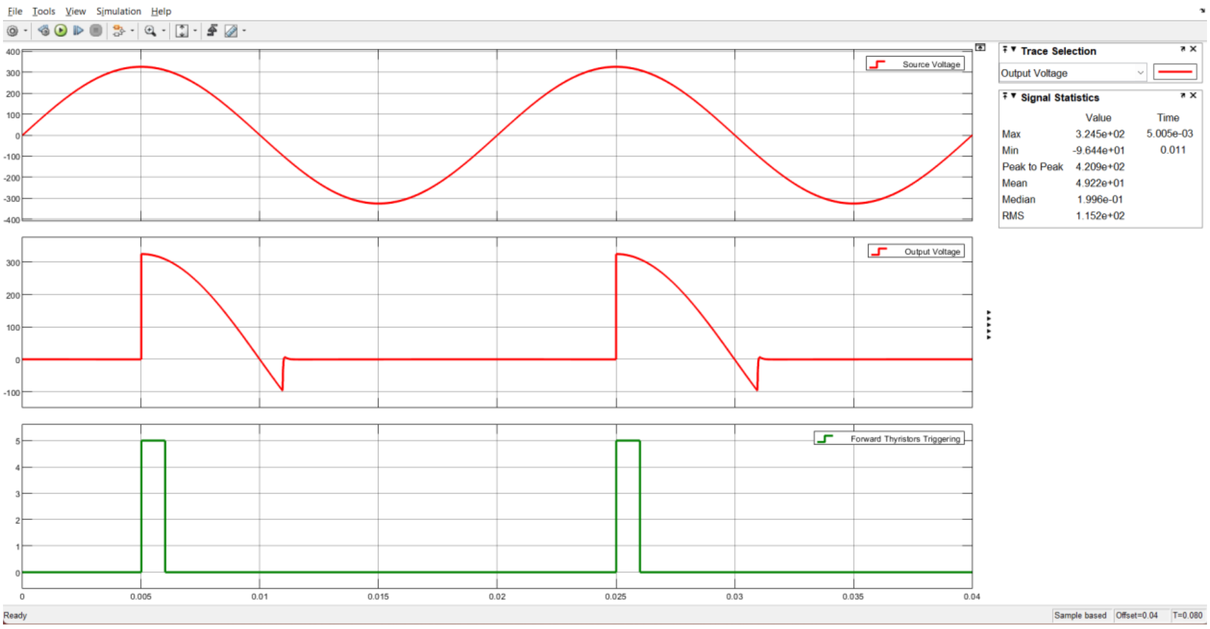
2. α=60°



Average voltage: 93.86 Volts

RMS voltage: 160.2 Volts

3. α=90°



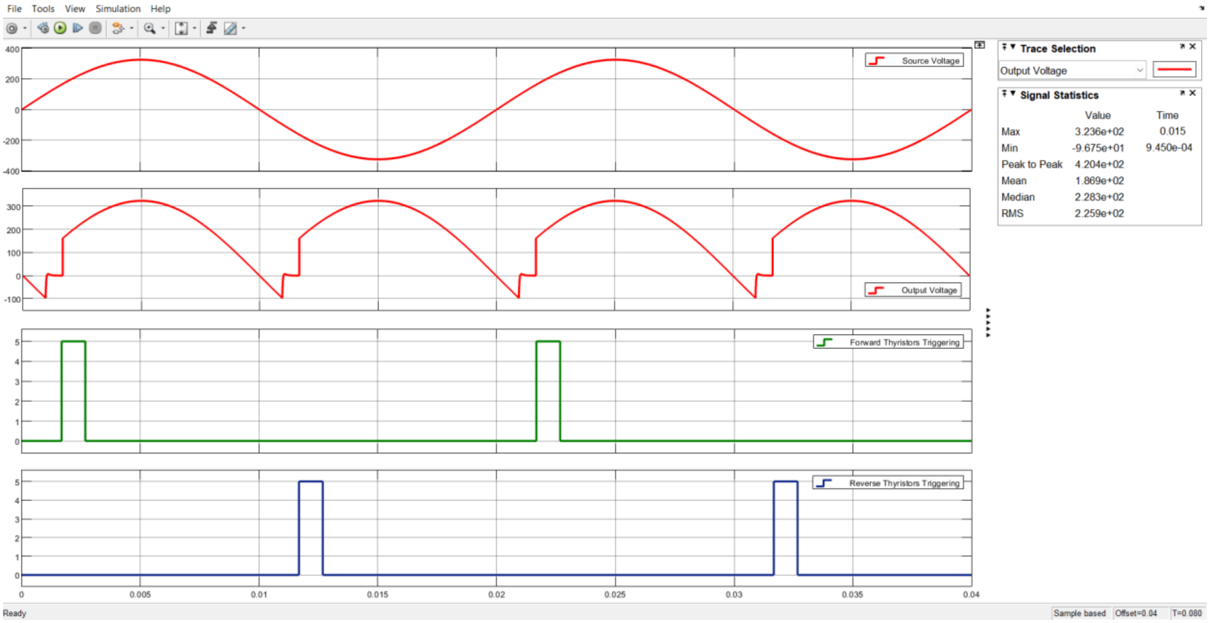
Average voltage: 49.22 Volts

RMS voltage: 115.2 Volts

The presence of the L load in addition to the R load reduces the average output voltage. In all three cases, the conduction is discontinuous

B. Single-Phase Full-Wave Controlled Rectifier (Bridge)

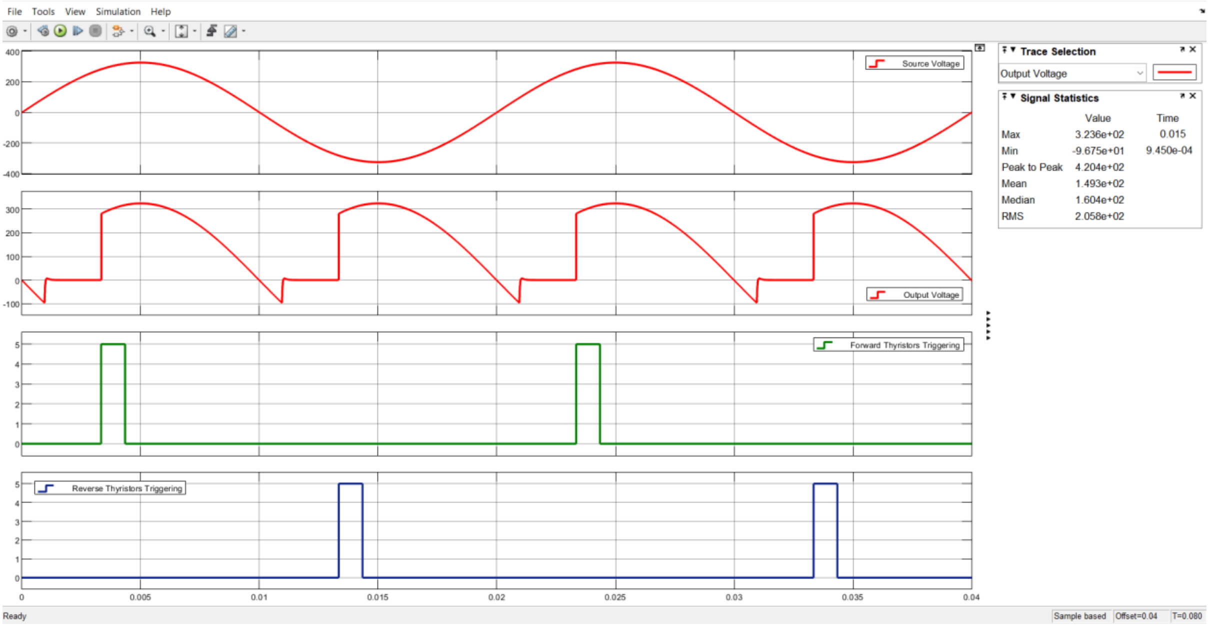
α=30°



Average voltage: 186.9 Volts

RMS voltage: 225.9 Volts

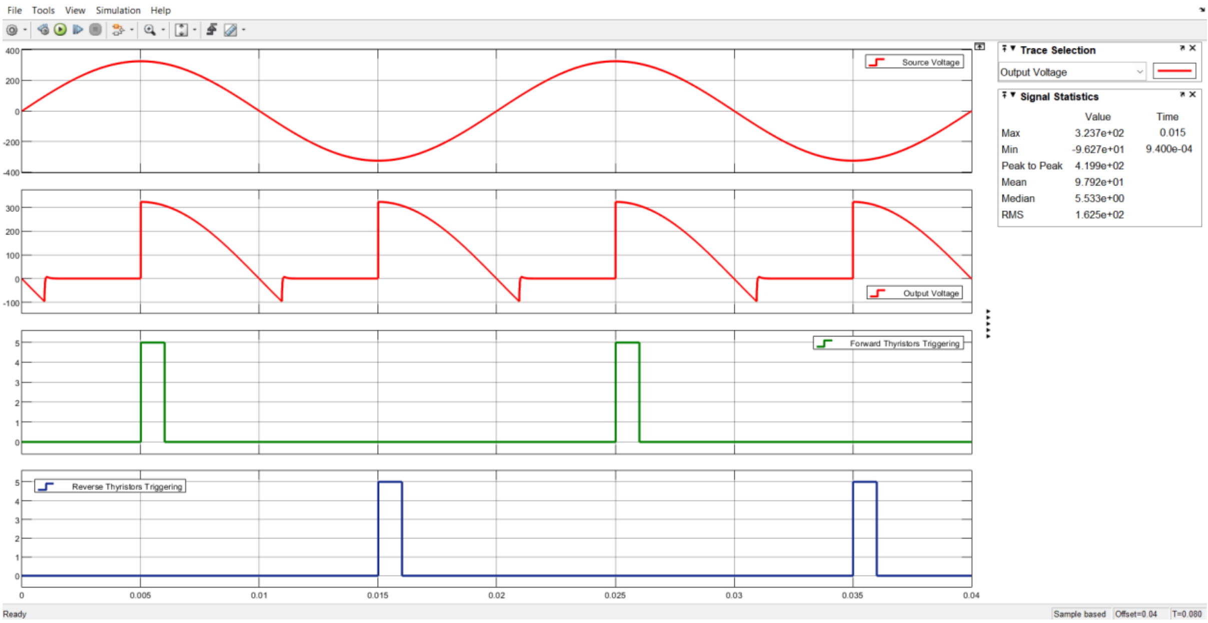
α=60°



Average voltage: 149.3 Volts

RMS voltage: 205.8 Volts

α=90°



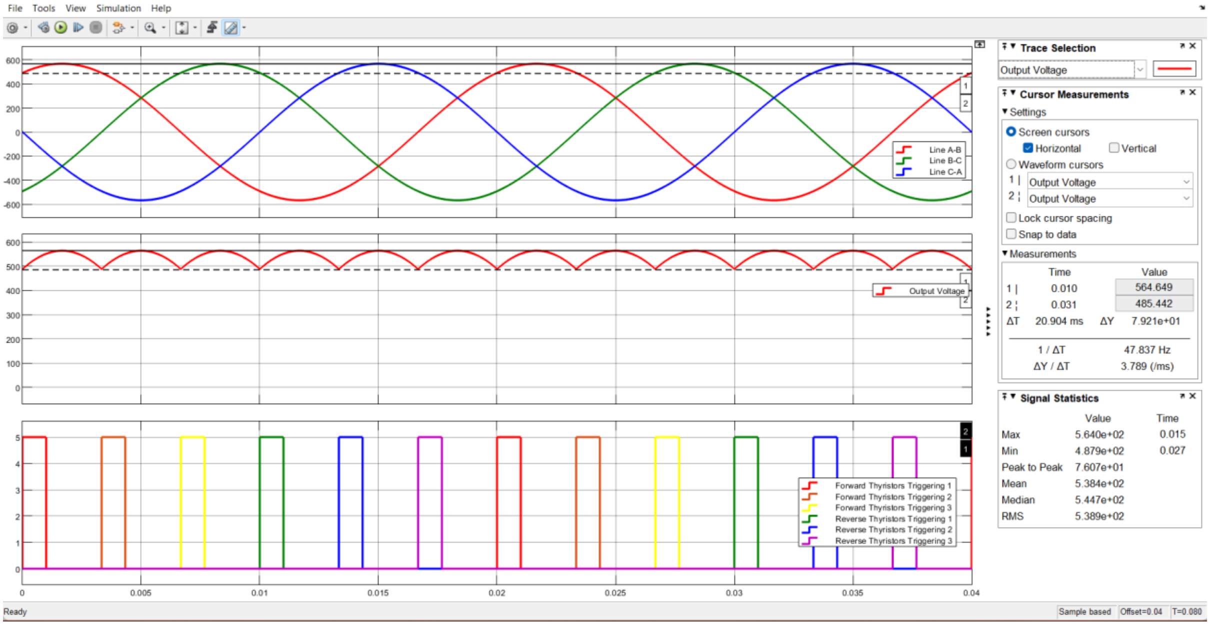
Average voltage: 97.92 Volts

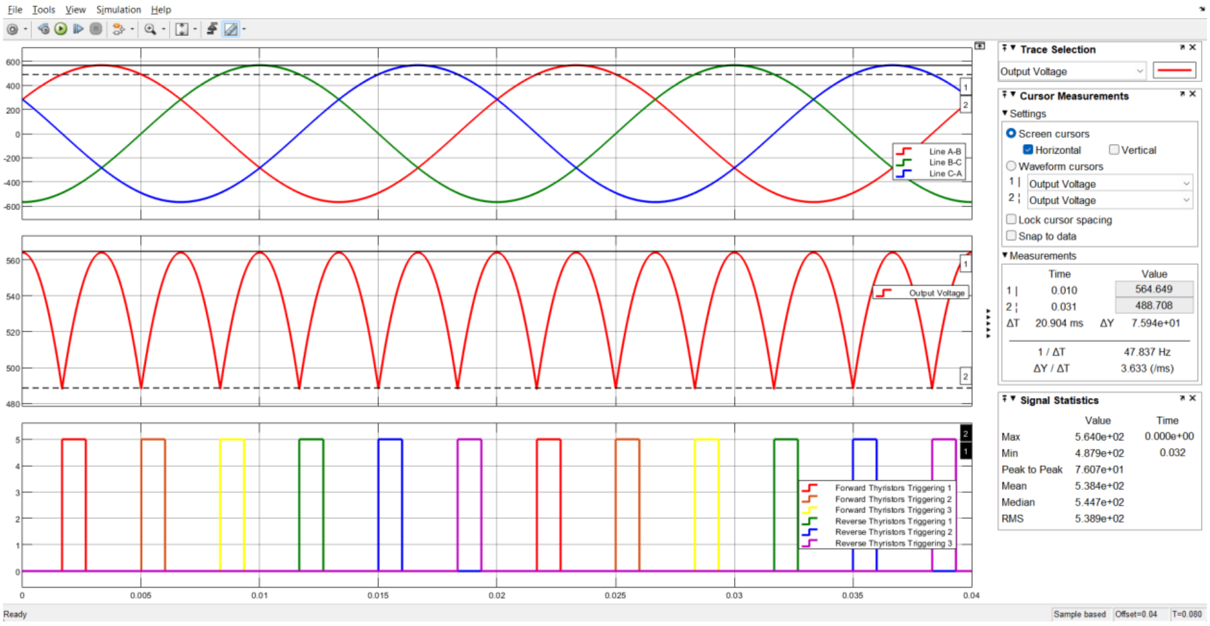
RMS voltage: 162.5 Volts

C. Three-Phase Fully Controlled Bridge Rectifier

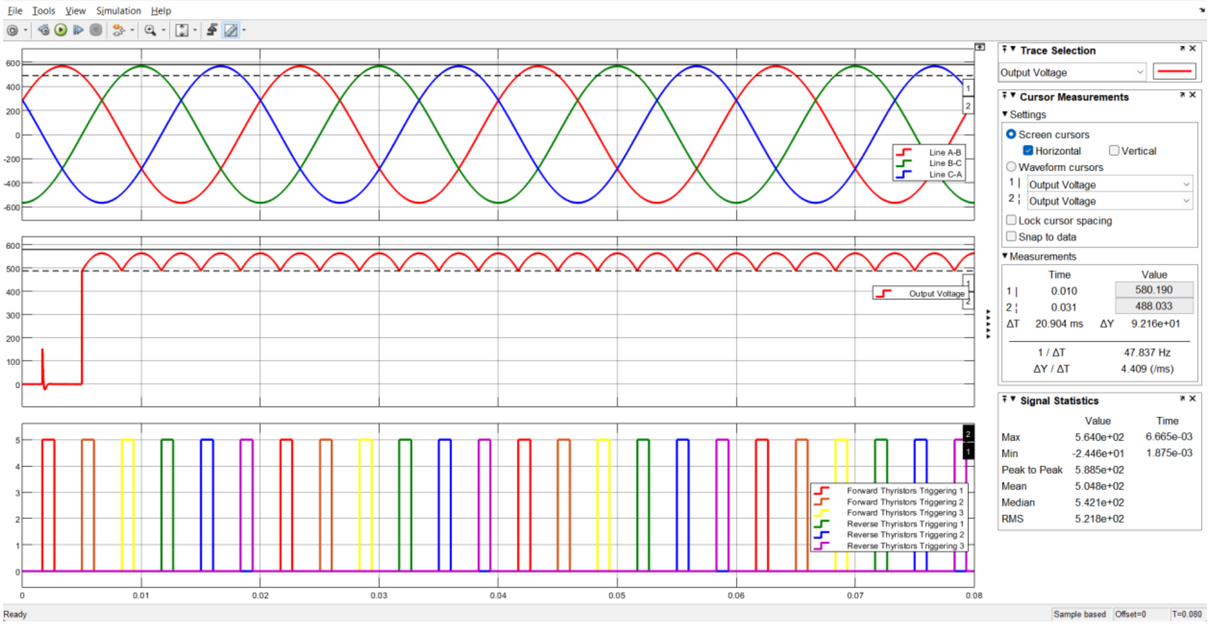
1. α=0°

This is exactly the same appearance as an uncontrolled 3 phase rectifier. The voltage ripple is 563.3-485 which is roughly 80 volts. Below is the waveform for uncontrolled with only a R load

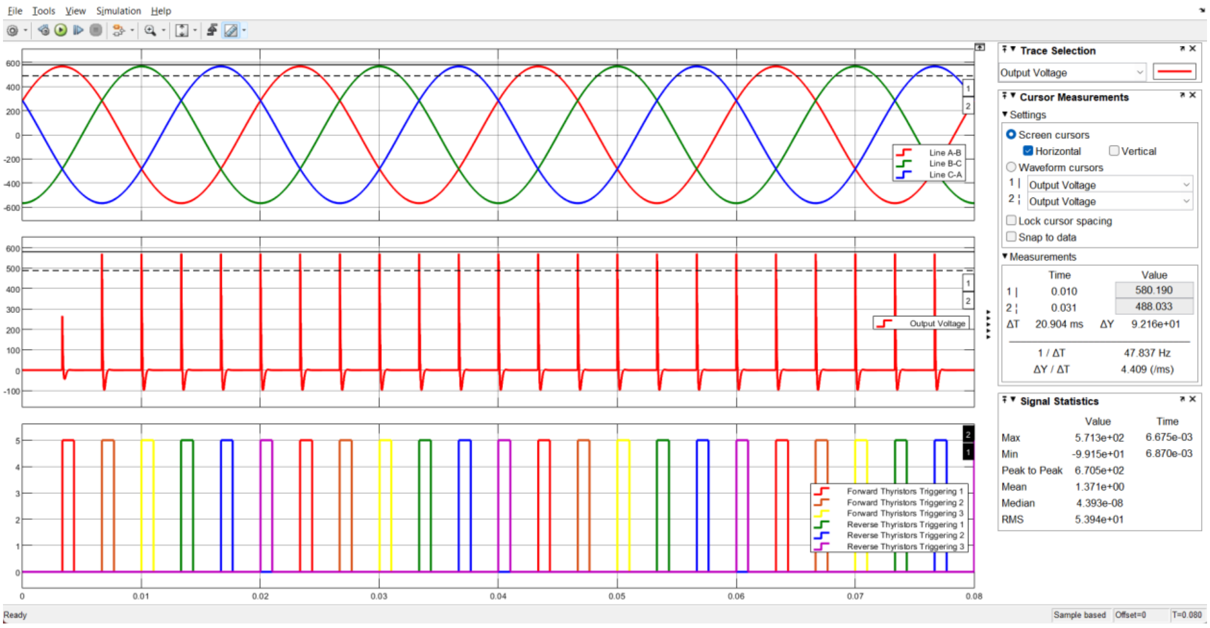




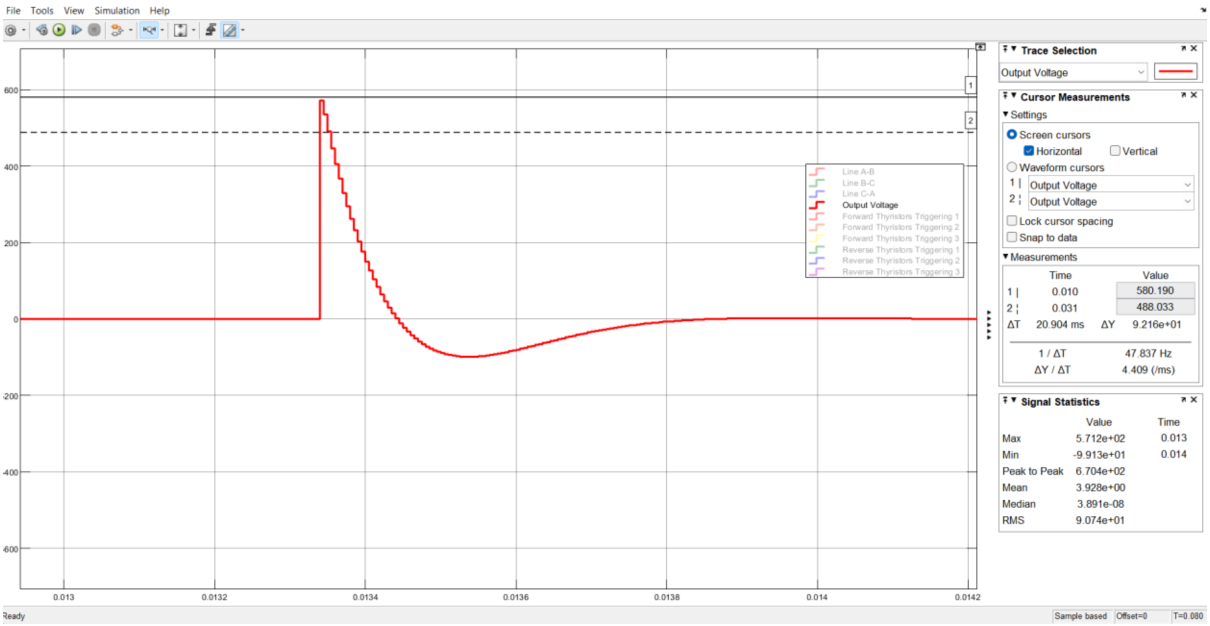
Controlled, With the 0° firing angle R-L load



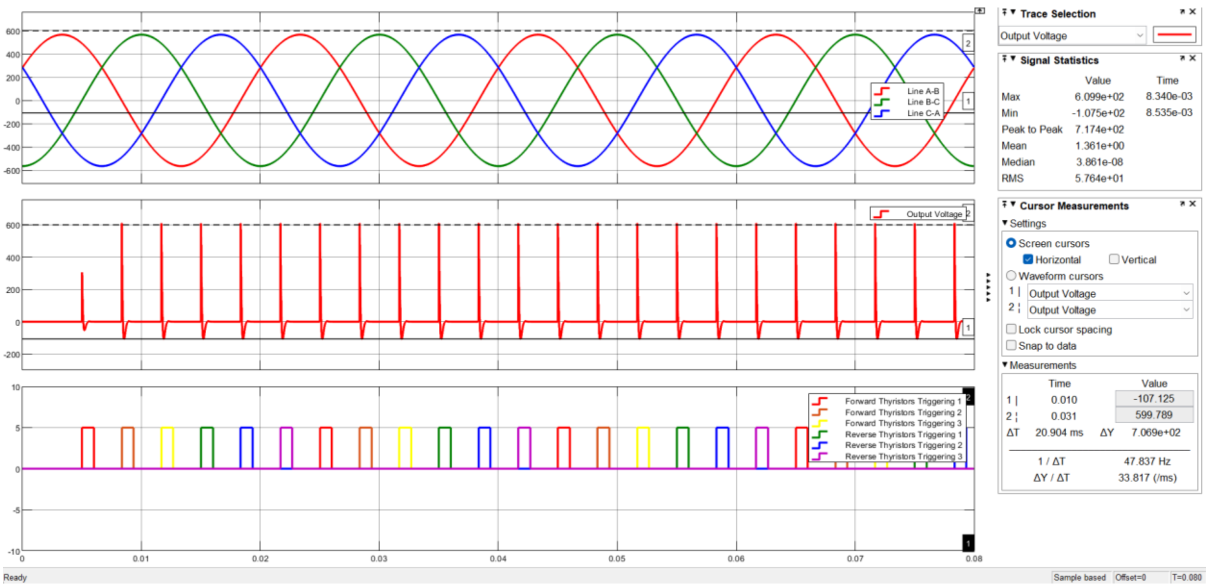
2. α=30°



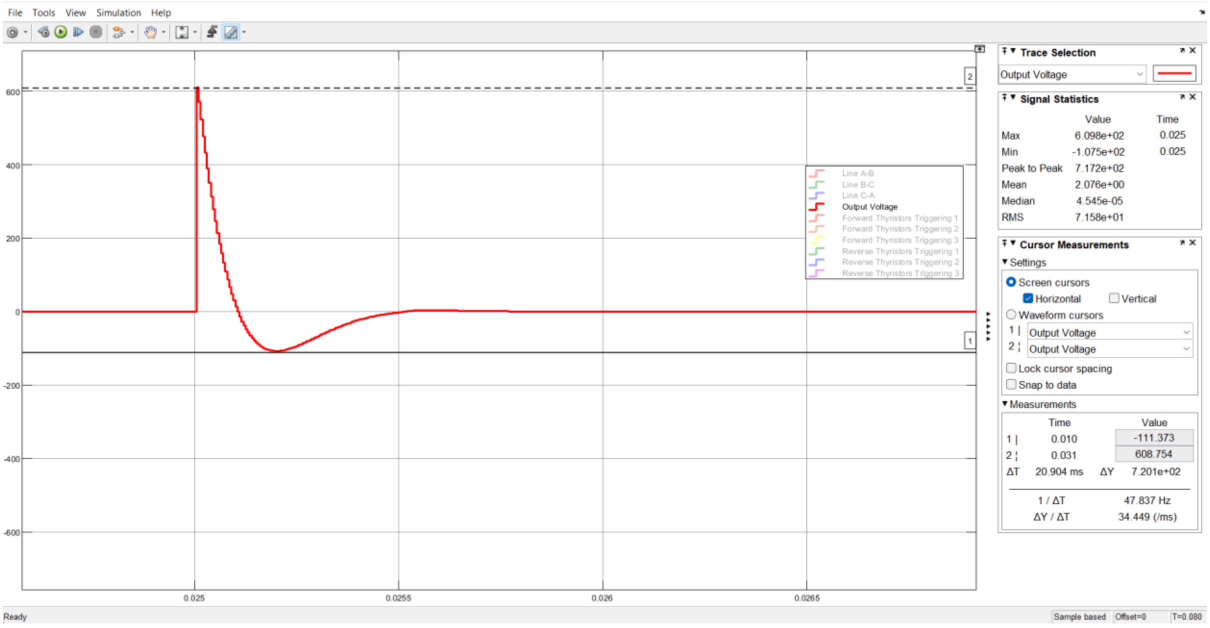
Zoomed in



3. α=60°



At 60 degrees firing, the peak of the wave is higher than the source peak. THD is caused by higher-order harmonics (multiples of the fundamental frequency) in the waveform. This is seen in the zoomed in version of the plots. THD can cause transient spikes that increase the peak output voltage.



THD is lower than at higher firing angles, but still present due to ripple. At α = 0°, the waveform is more continuous and has a higher DC level. At α = 30°: The waveform becomes discontinuous, creating higher THD and reducing the DC level.