**EE 463 STATIC POWER CONSERVATION-PROJECT 1**

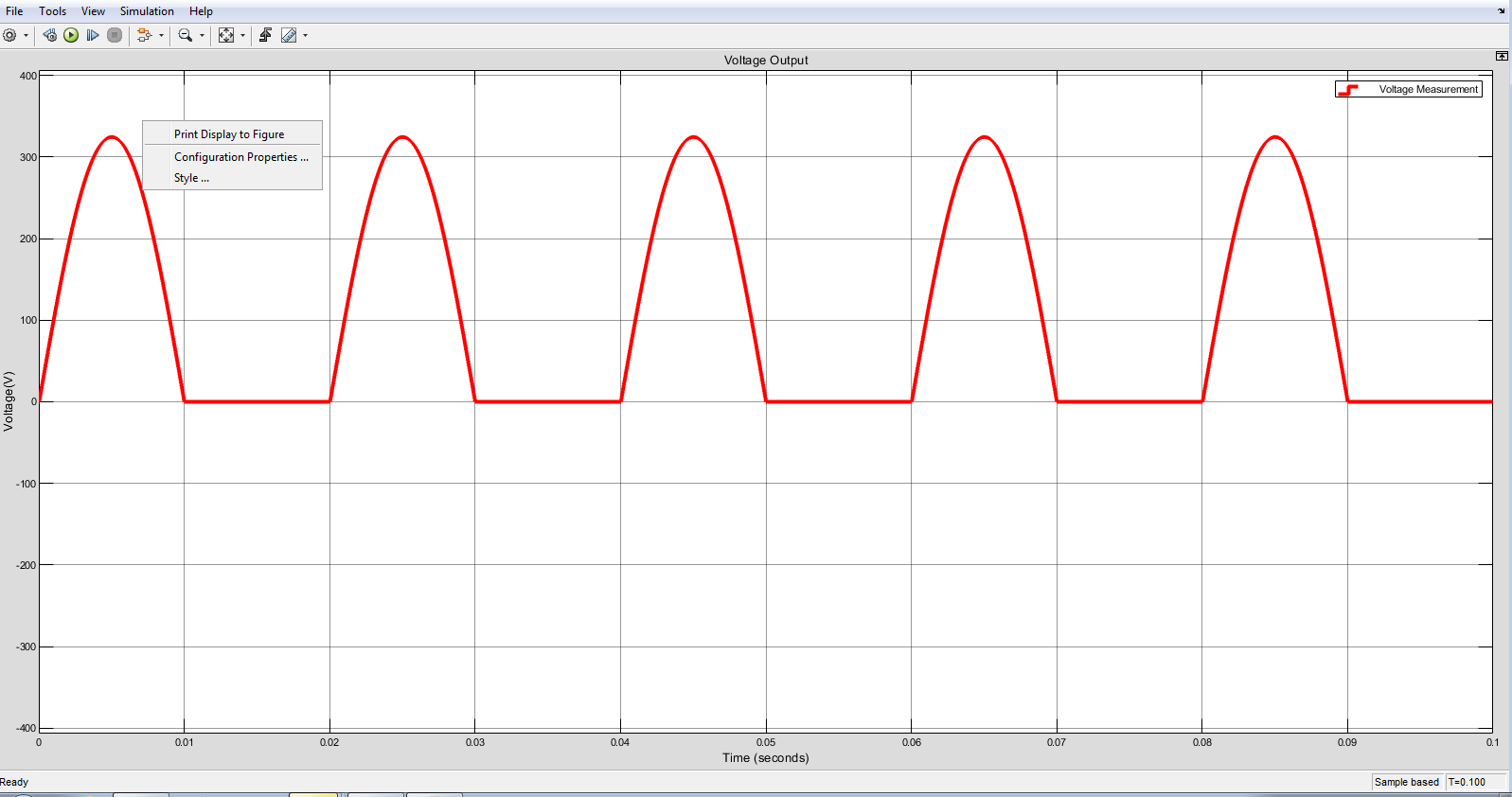
**REPORT**

**Hamza SOLAK-2263762**

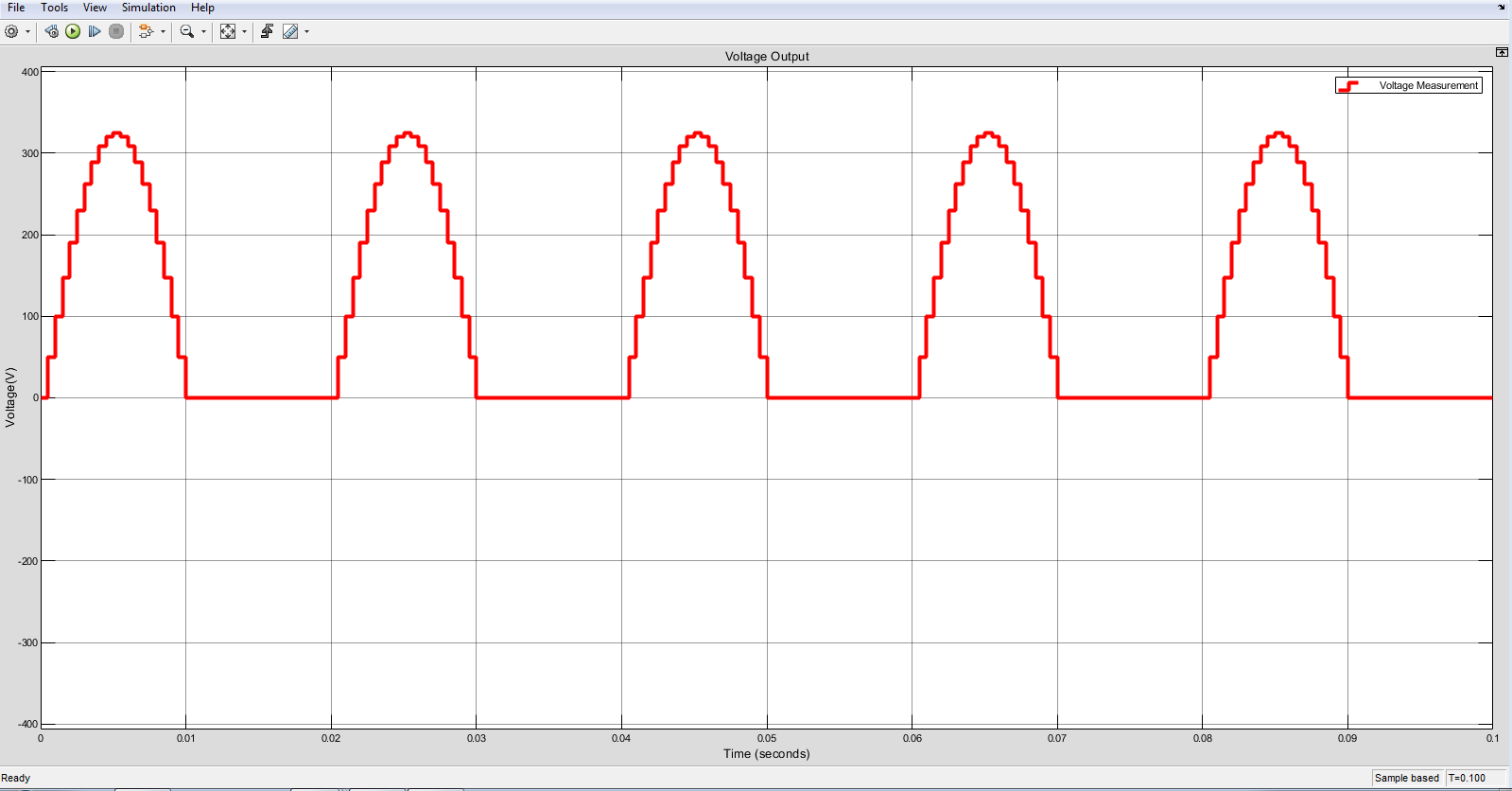
**Muhammet BARIŞ-**

**Question 1)**

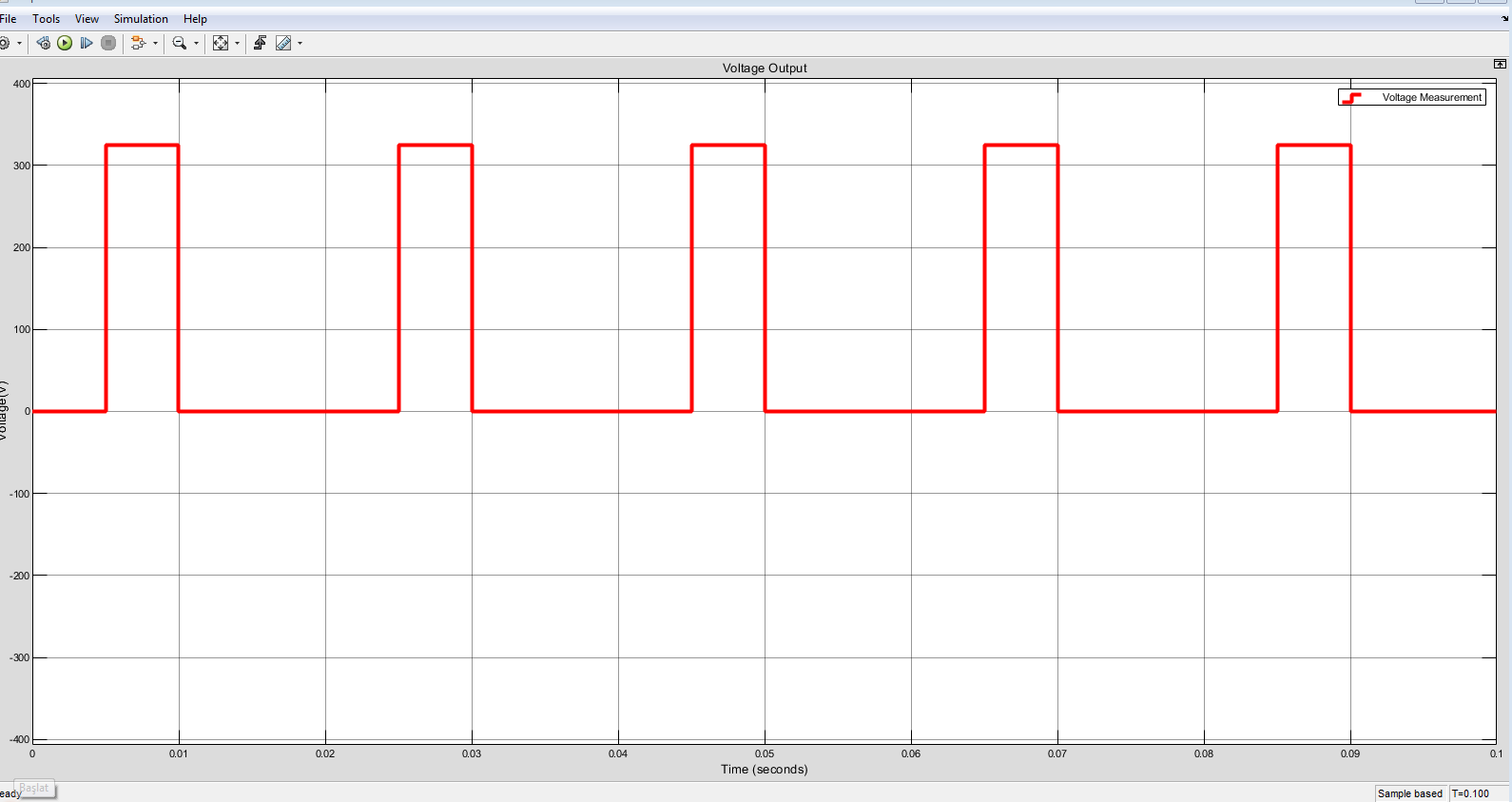
1. Voltage output of single-phase half bridge rectifier can be observed in figure 1,2,3.



*Figure 1: Output voltage of half bridge rectifier in 1ns*



*Figure 2: Output voltage of half bridge rectifier in 0.5ms*



*Figure 3: Output voltage of half bridge rectifier in 5ms*

1. Nearly pure sinusoidal waveform is observed in figure 1. İts step time is 1ns so it is more sinusoidal than others. It samples in Nano seconds range so it is more detailed.
2. Average voltage formula is given below

*Vav=*

*=(2Vsrms\*)/(2\*pi)= 0,45Vsrms*

*=103.5V*

For calculation THD harmonics of wave must be calculated. In first step Fourier transformation must be made. Current wave equations are given below

*I(t)= 0 when –pi/w<t<0*

*I(t)= Imax\*sin(wt) when 0<t<pi/w*

*a0==*

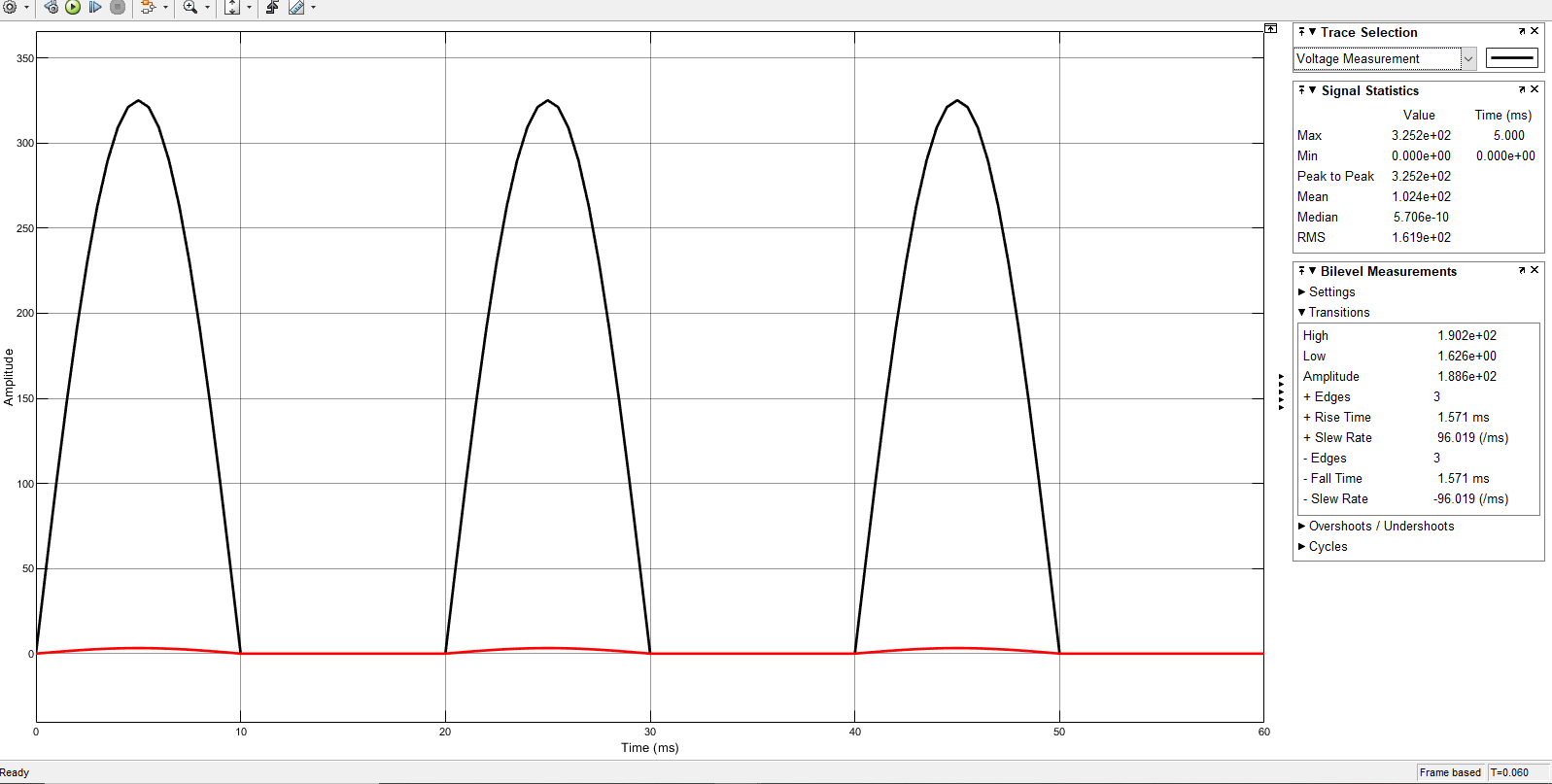
*an=0 when n=1,3,5,7…*

*an= for n=2,4,6,8…*

*b1=1/2*

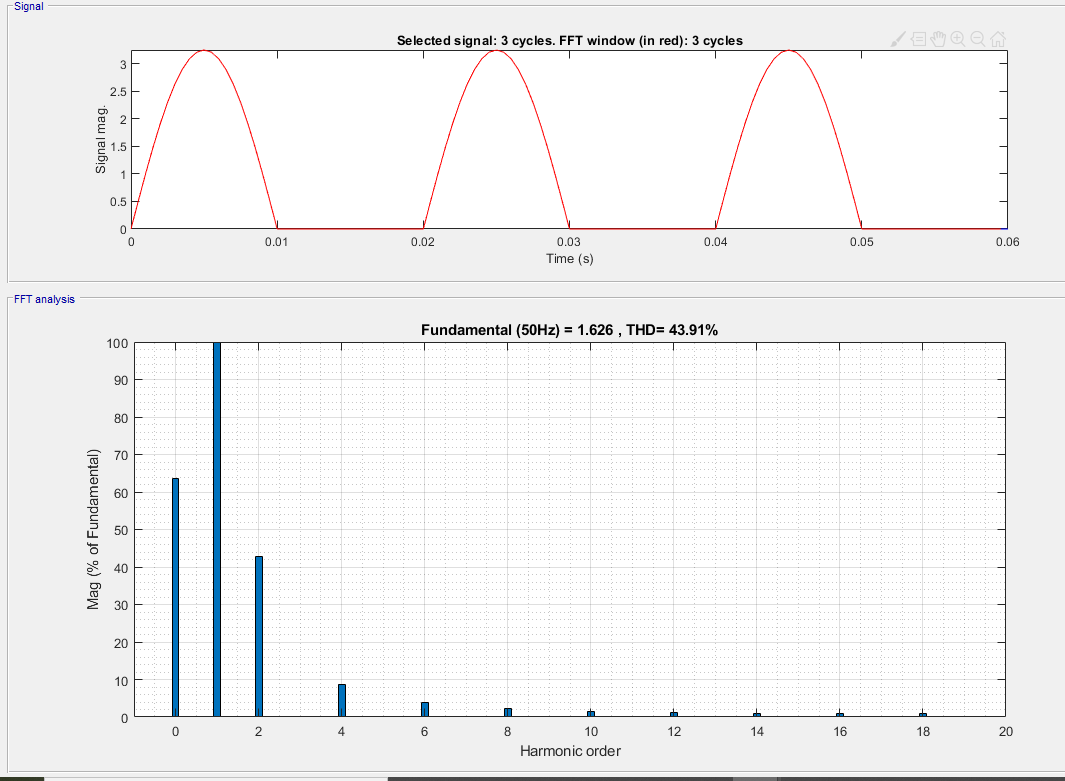
*bn=0 for all n values*

*THD=*



*Figure 4: Mean of output voltage*

In matlab there is some no idealities on diode because we cannot make diode ideal in matlab because simulation is not work when we made diode ideal. But mean is very close the calculation as we see in figure 4.

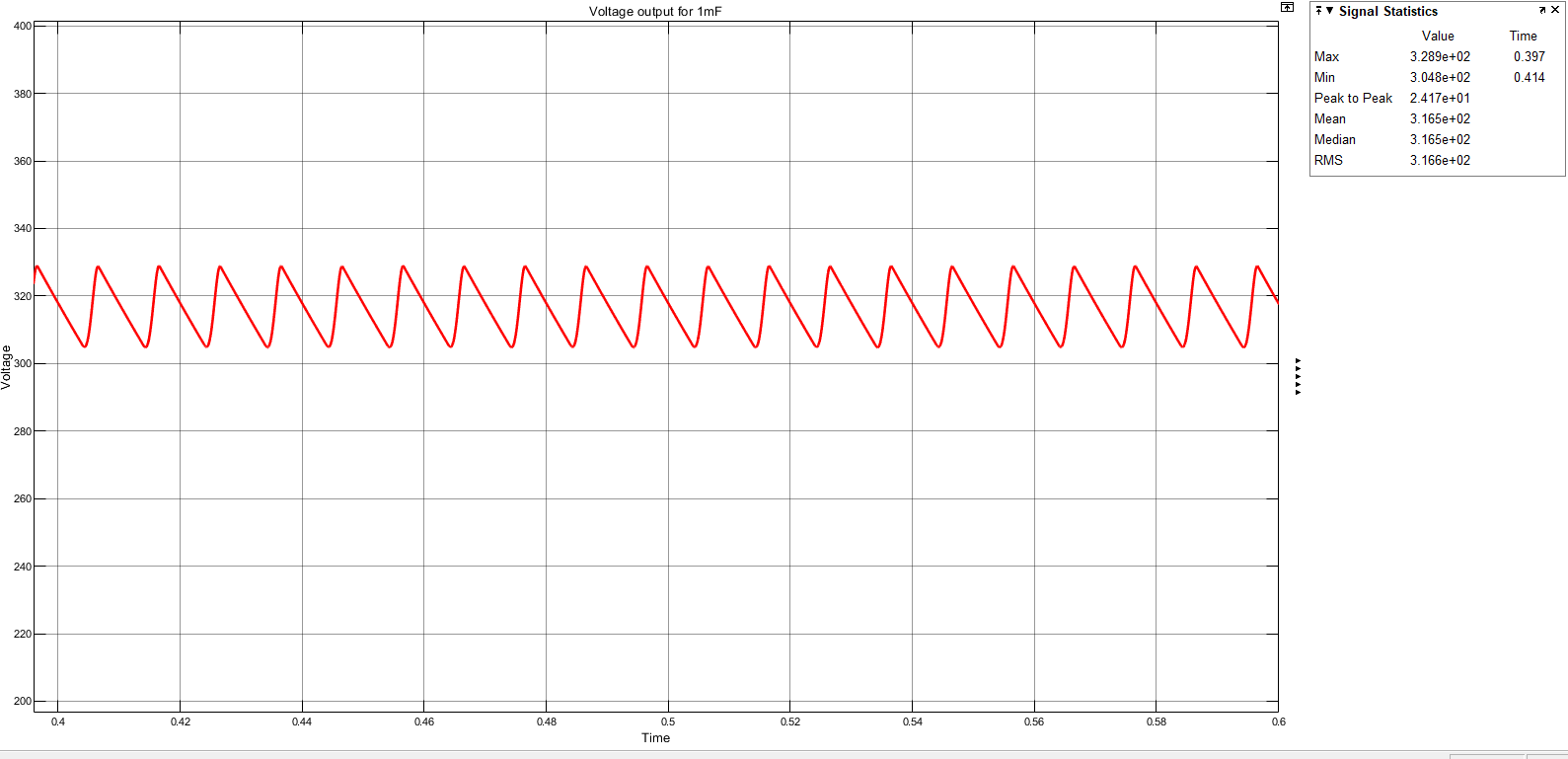


*Figure 5: THD measurement of input current*

We find THD values smaller than measurement values because we cannot sum all harmonic waves because it goes to infinity. But computer can sum very long rage of harmonics so it is THD value is bigger than calculated value but they are nearly same because as we see in figure 5 when harmonics increase magnitude is decrease so it affects calculation very small range.

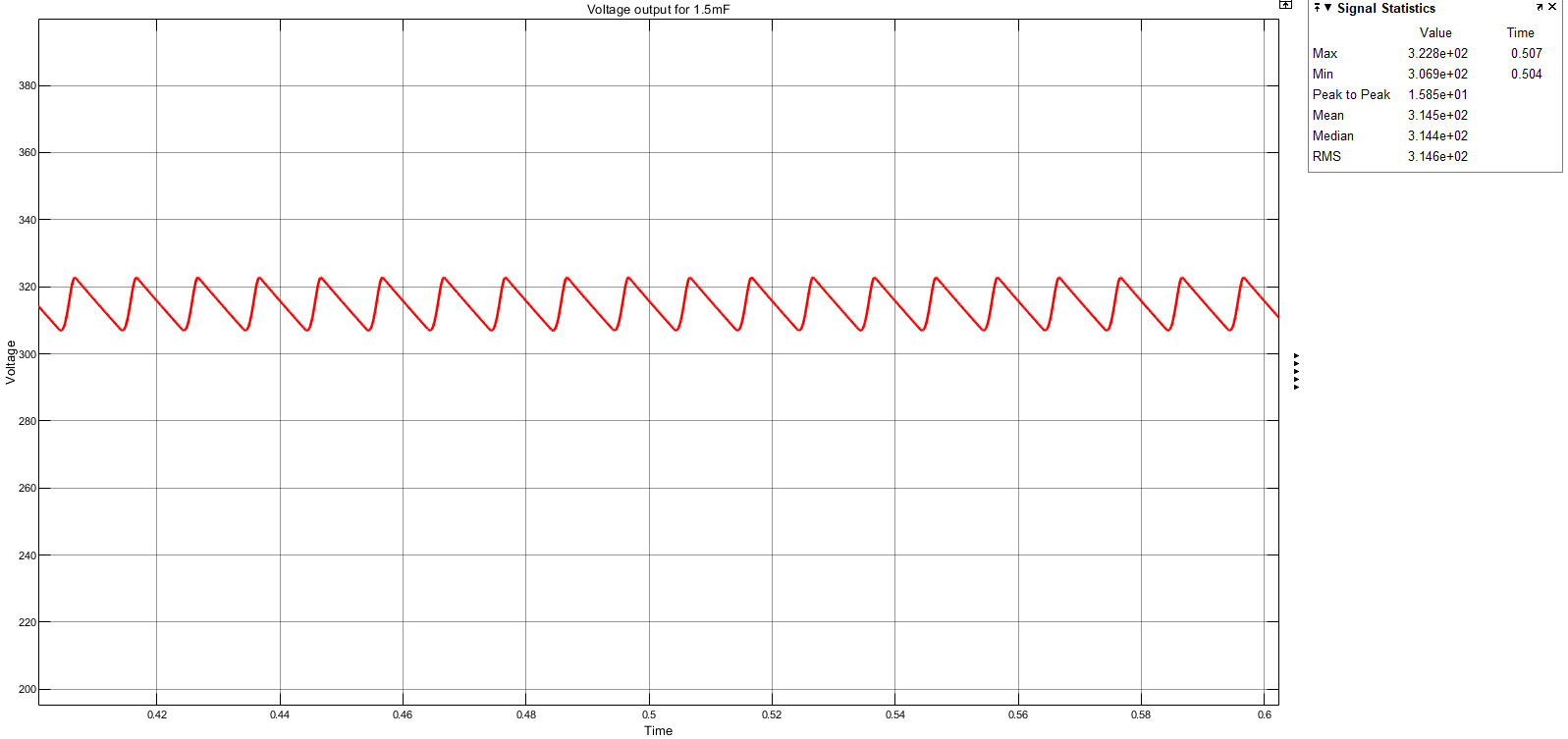
**Question 2)**

1. In the circuit Ls and Rs represents inductance and resistance of grid line because we take power from grid and it came with transmission cable and it has inductance and resistance.
2. In simulation I try a big capacitance for decreasing output voltage peak-to-peak ripple. Firstly, we tried 1mF I take output which is shown in figure 5.



*Figure 6: Voltage output for 1mF*

It is peak to peak ripple is %7 so capacitance value must be increased. 1.5mF is the suitable for %5 peak to peak ripple value.

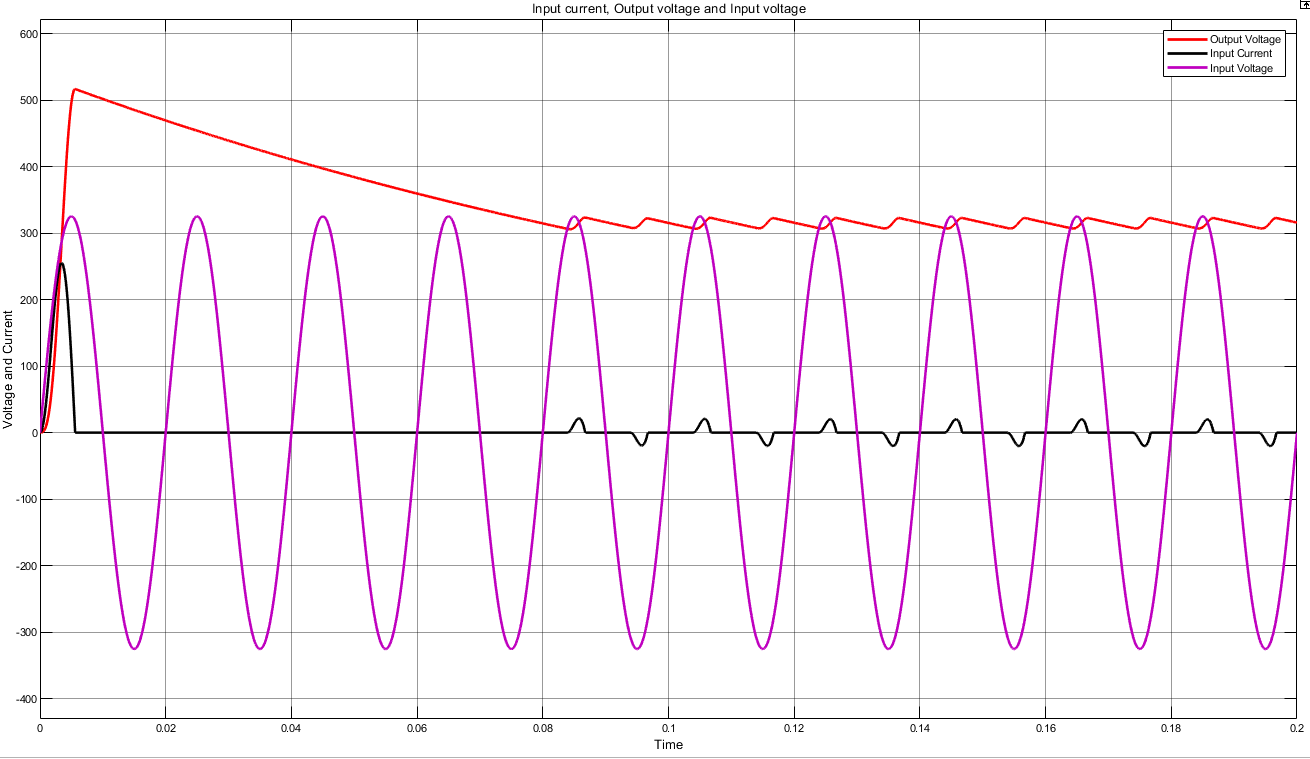


*Figure 7: Voltage output for 1.5mF*

As we see in figure 6 peak to peak voltage is 16V as we calculate peak to peak ripple value is

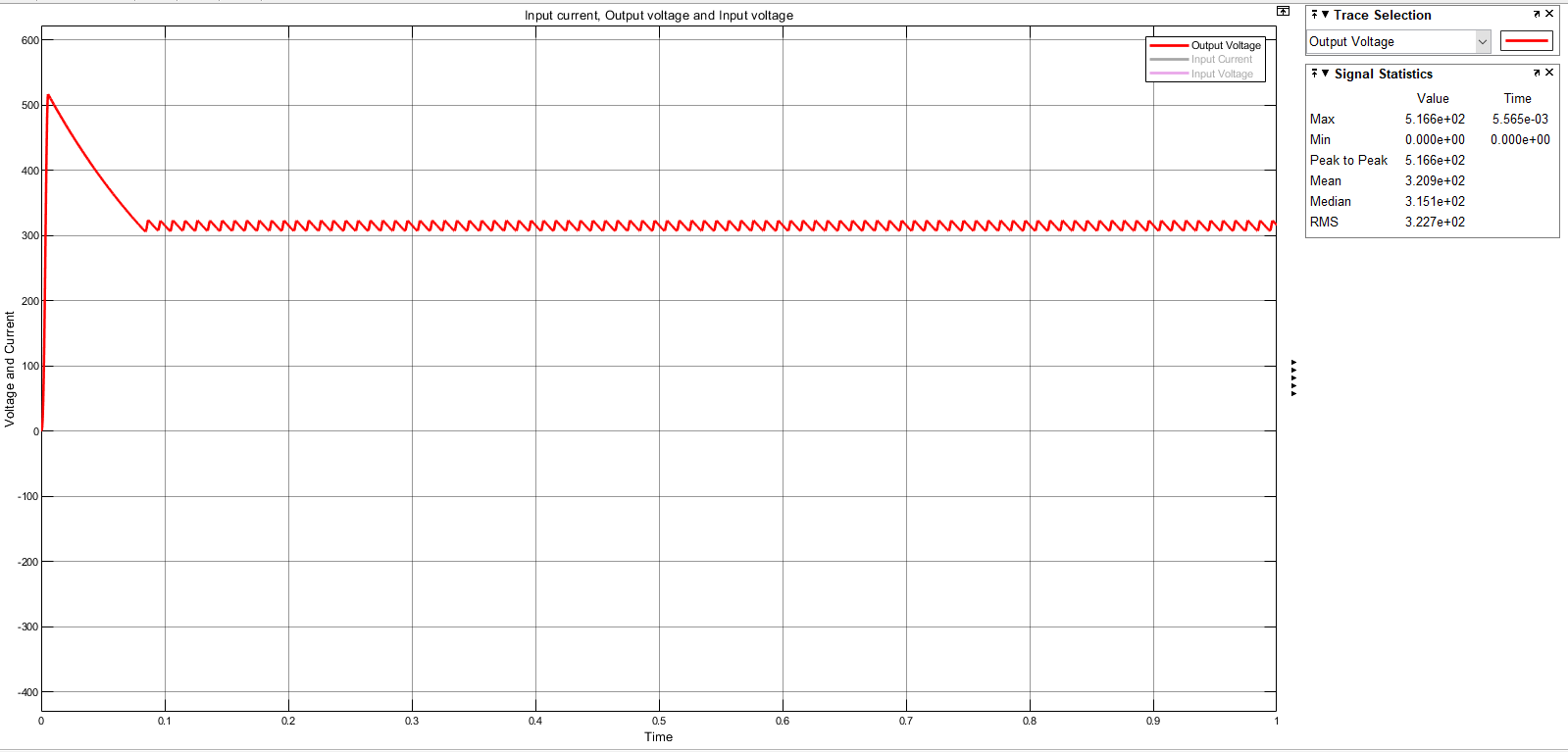
İt is near the %5 value.



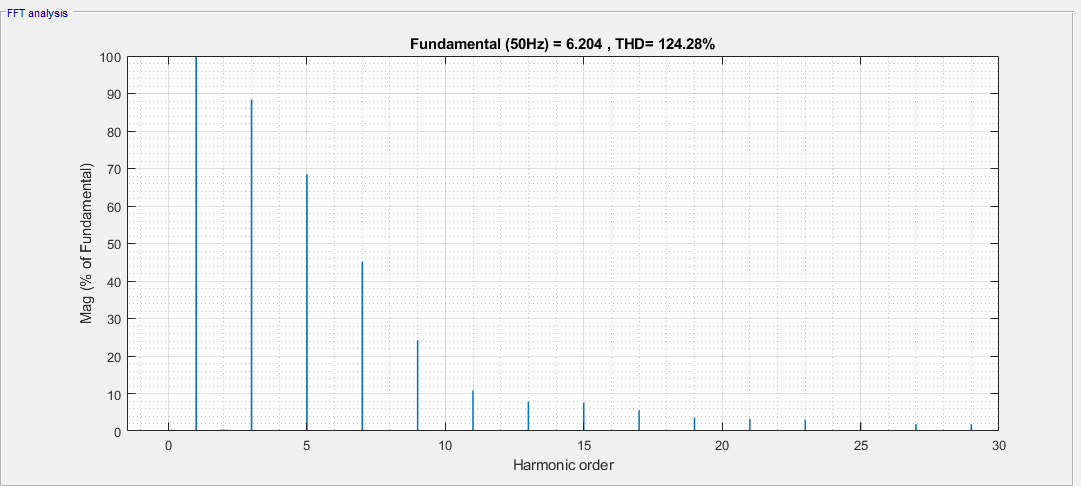
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*Figure 8: Input current input voltage and output current for full-wave rectifier*



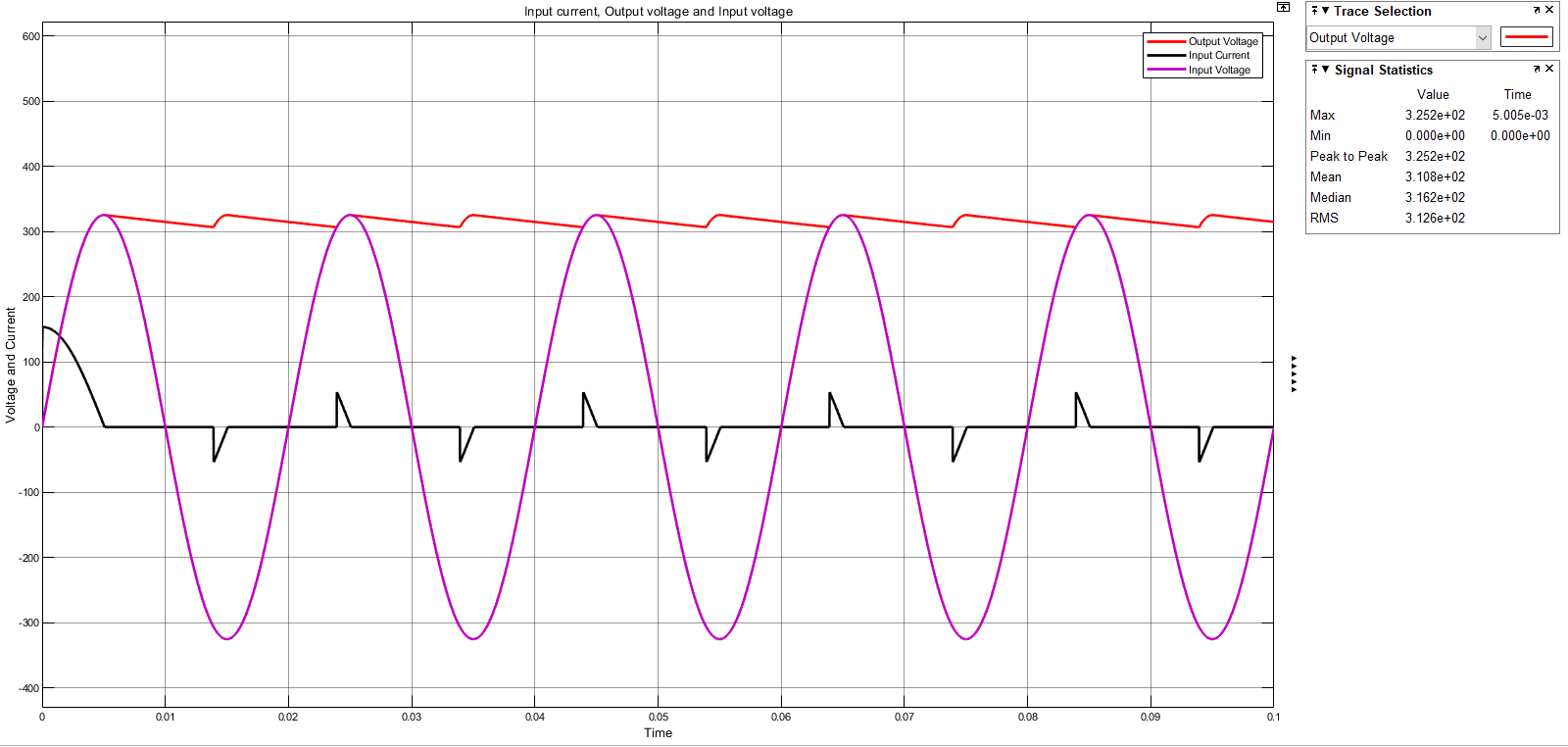
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*Figure 9: Average voltage of Output*

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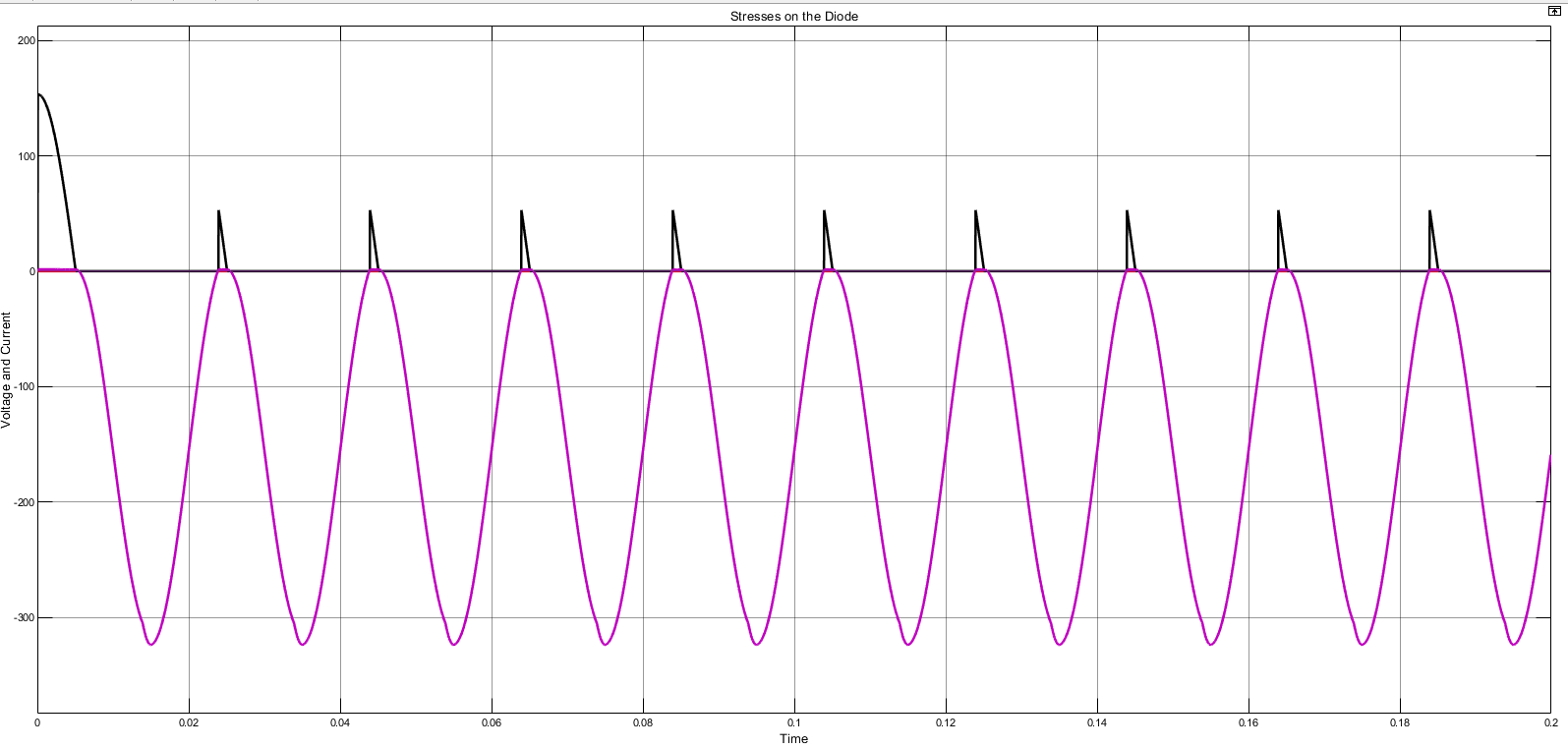
*Figure 10: THD of input current*



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*Figure 11: Input current input voltage and output current for full-wave rectifier without Rs and Ls*

1. Maximum input current is 53.5 A so we must choose 60A diode and maksimum reverse voltage is -325.5V so diode stand this valus so we choose 400V 60A diode. It is part number is APT60D40BG. It is manufacturer is Microsemi Corporation. Non-Repetitive Forward Surge Current is 600A as we see in figures we can not reach the 600A so we can use this diode.

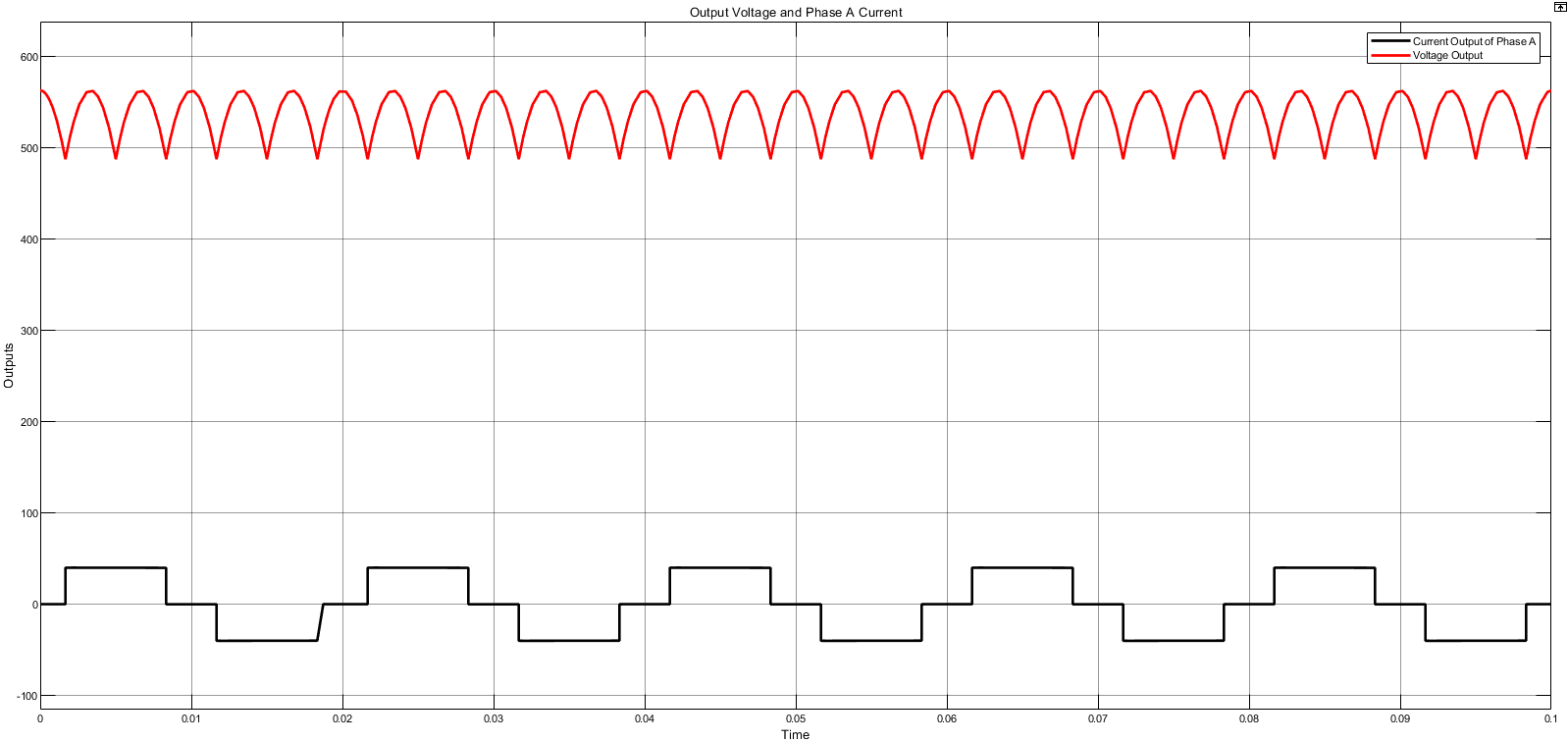
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*Figure 12: Stresses on the diode*

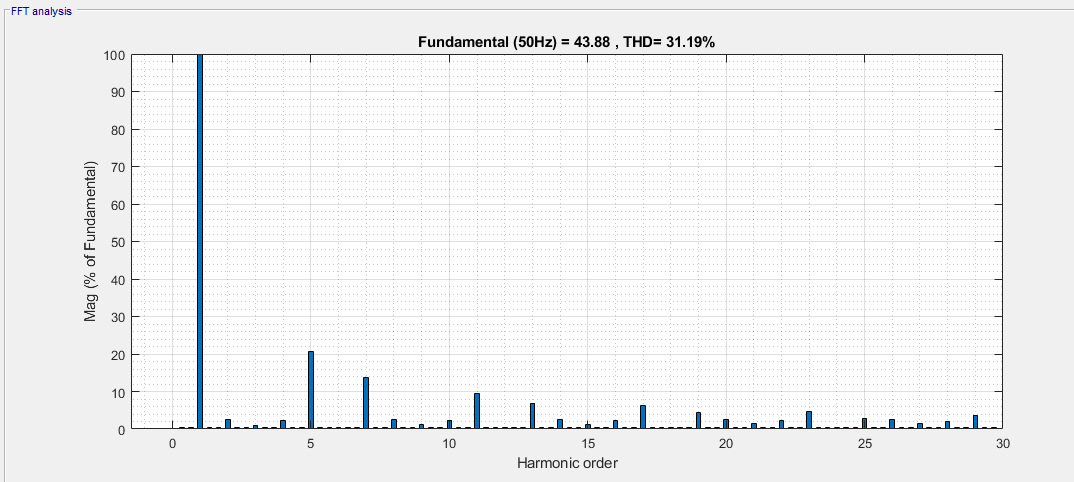


**Q3)**

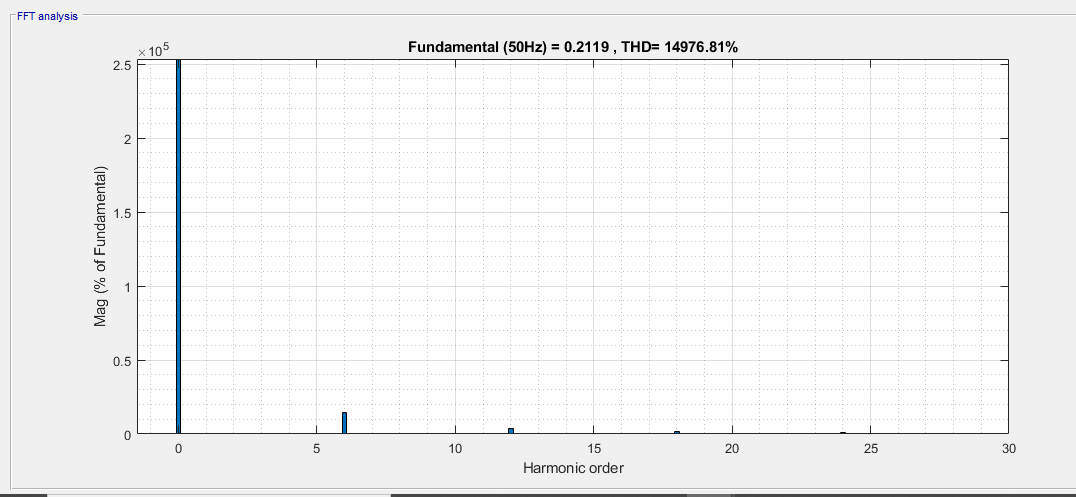
1. MEAN İS 522V

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*Figure 13: Phase A current and output voltages*

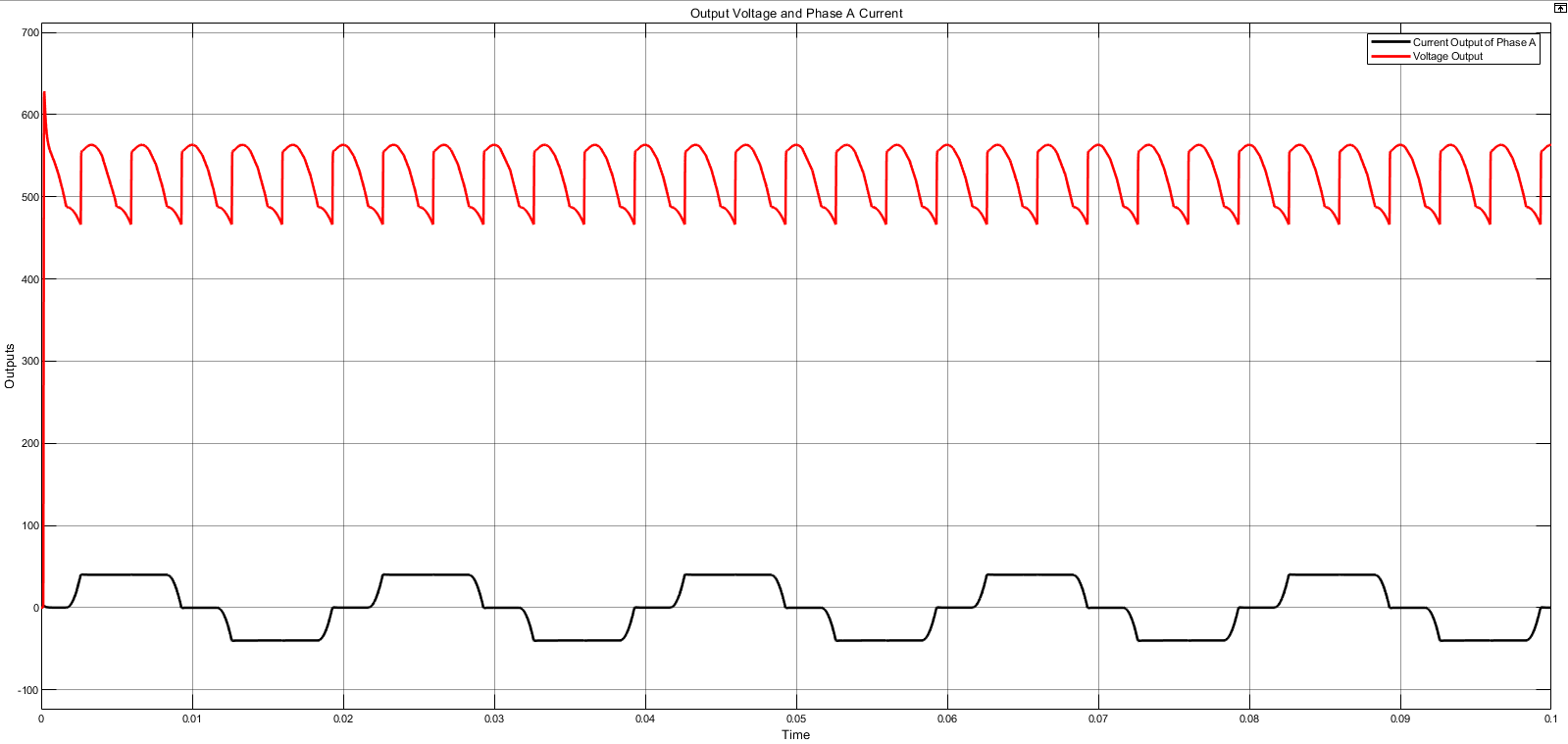
1. Analiticly calculate
2. 

*Figure 14: Harmonic analysis for input current*



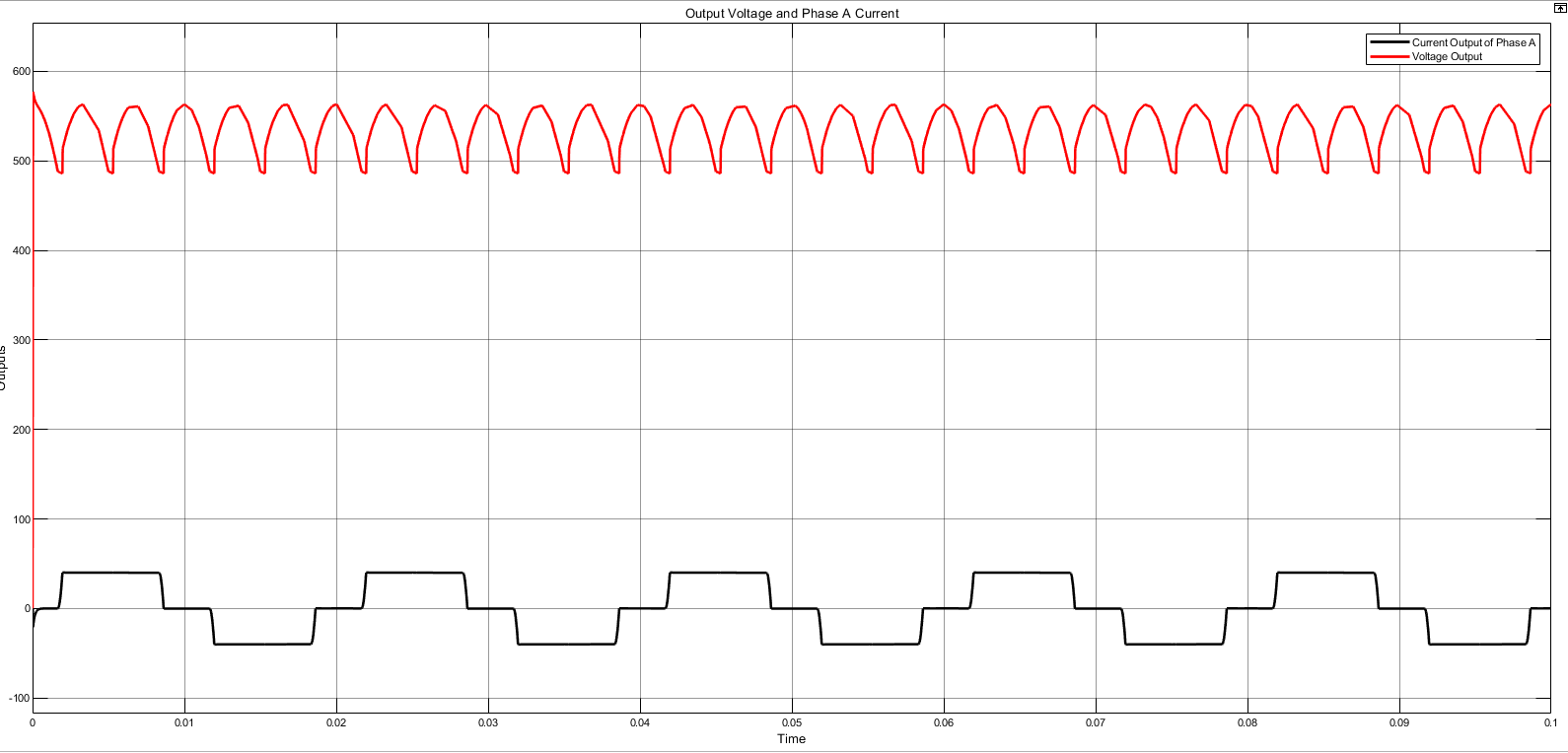
*Figure 15: Harmonic analysis for output voltages*

1. MEAN İS 509V

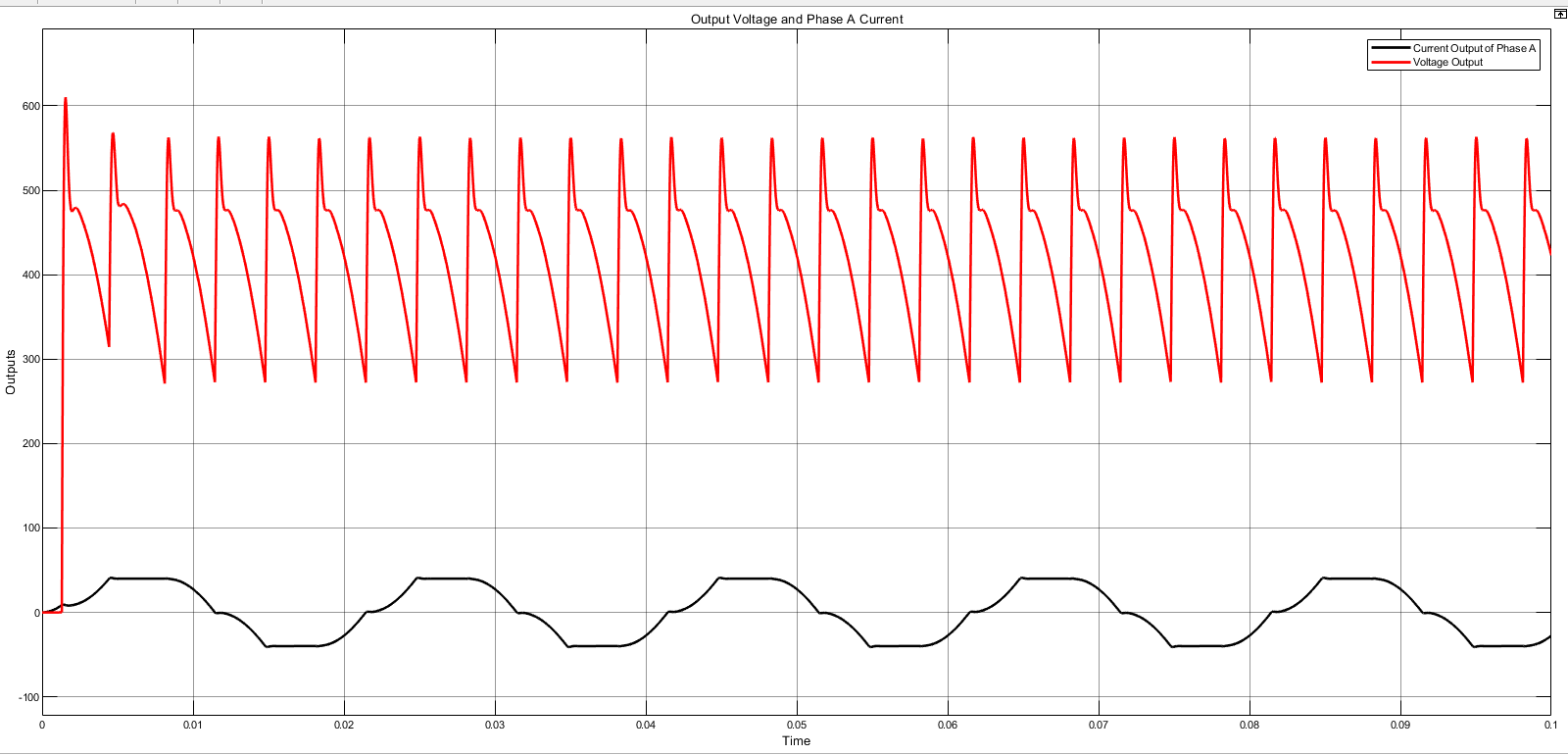


*Figure 16: Phase A current and output voltages for 1mH*

1. **Repeat c**



*Figure 17: Phase A current and output voltages for 0.1mH*



*Figure 18: Phase A current and output voltages for 10mH*