ENEE2360

Instructor: Dr. Nasser Ismail

Prepared by: Islam Jihad

ID: 1191375

Section: 1

Date: 16 \ 8 \ 2020

contents

Design a rectifier with filter to provide a load (RL=0.75 kohm) with an average voltage equal to 32Vdc with a ripple factor = ~7%,
Input voltage Vin is sinusoidal with 220Vrms, f=50 Hz: assume practical diodes
perform the design using all three rectifier types:

1. Half Wave rectifier
2. Bridge Full wave rectifier
3. Center tapped transformer full wave rectifier

Simulate the designed circuits using Pspice student edition

Write a simple report which includes:

-design calculations for each circuit including transformer and filter design

-simulation circuits and results

-comparison of simulation results to design target

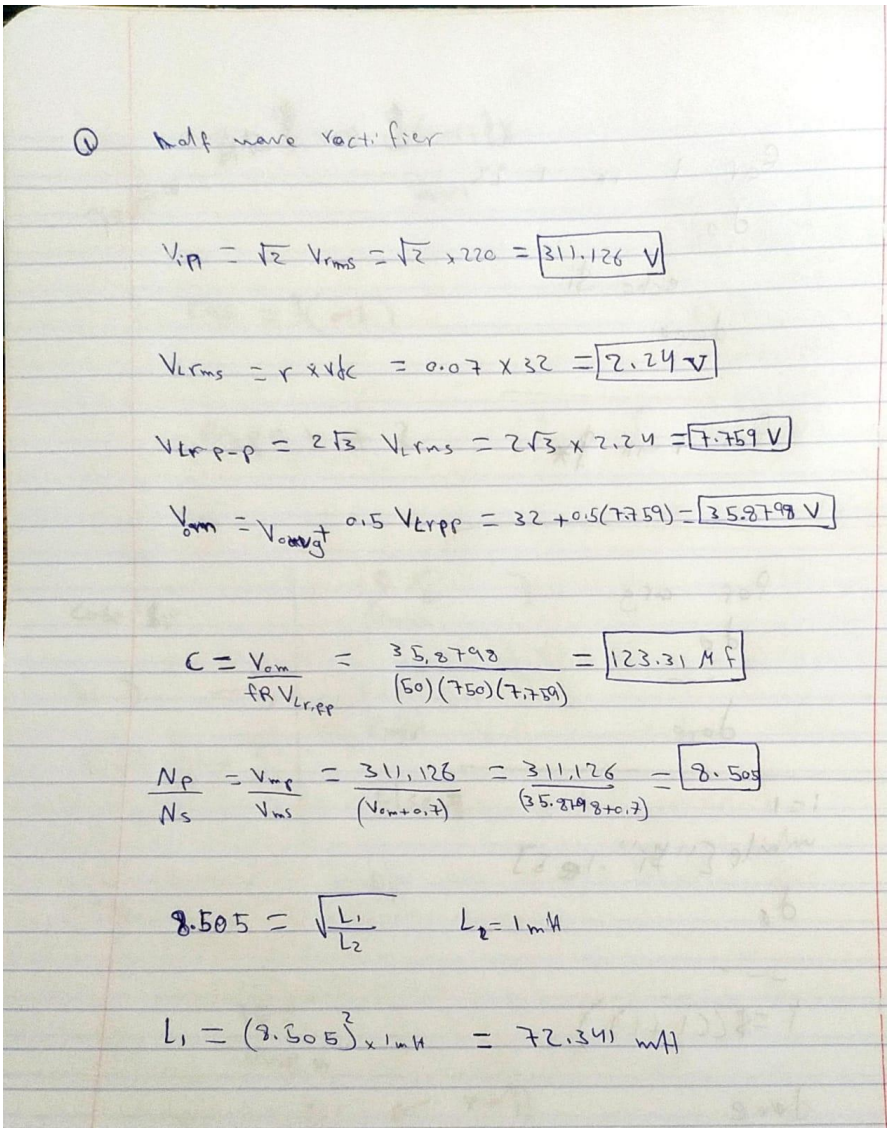
-conclusion

Abstract

The aim of this assignment is to study and apply on PSpice the half, full and center tapped rectifiers applications circuits that used to convert from ac to dc.

1. Half Wave rectifier

Design and calculations



① Half wave rectifier

$V_{ip} = \sqrt{2}\, V_{rms} = \sqrt{2} \times 220 = \boxed{311.126\ V}$

$V_{Lrms} = r \times V_{dc} = 0.07 \times 32 = \boxed{2.24\ V}$

$V_{Lr\,p-p} = 2\sqrt{3}\, V_{Lrms} = 2\sqrt{3} \times 2.24 = \boxed{7.759\ V}$

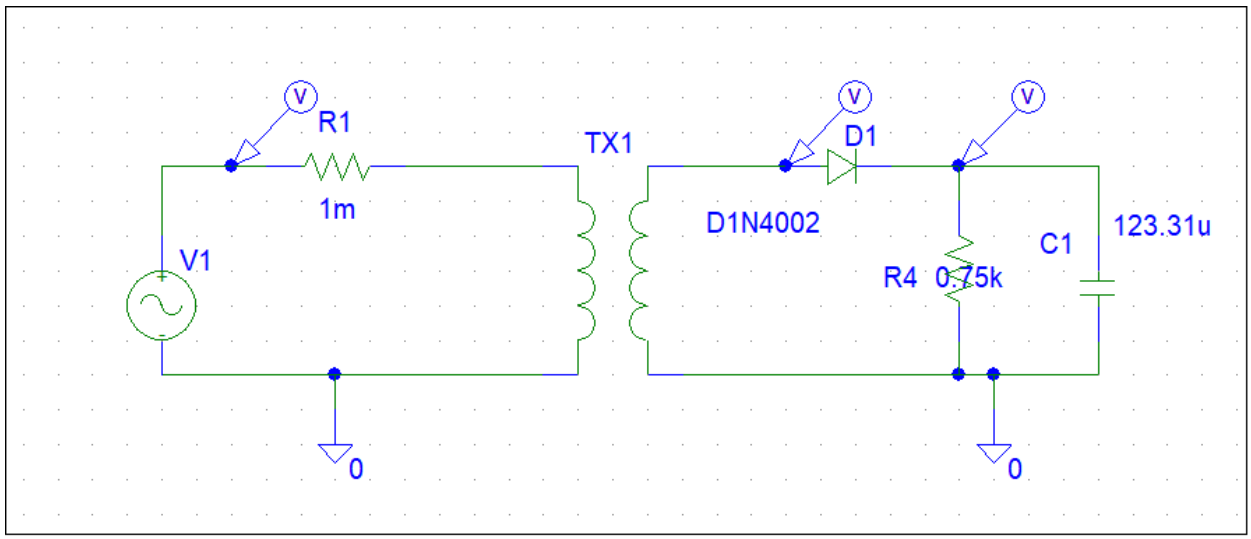
$V_{om} = V_{o\,avg} + 0.5\, V_{Lrpp} = 32 + 0.5(7.759) = \boxed{35.8798\ V}$

$C = \frac{V_{om}}{f_R V_{Lr,pp}} = \frac{35.8798}{(50)(750)(7.759)} = \boxed{123.31\ \mu f}$

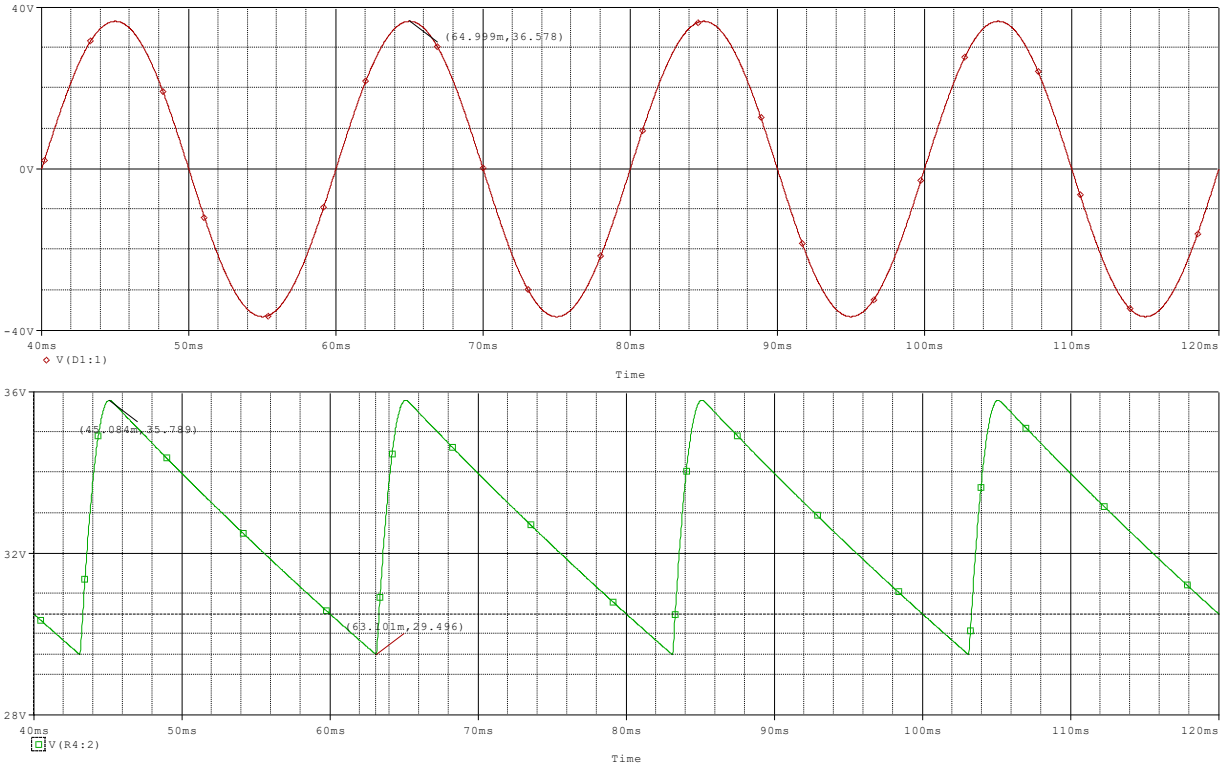
$\frac{N_p}{N_s} = \frac{V_{mp}}{V_{ms}} = \frac{311.126}{(V_{om}+0.7)} = \frac{311.126}{(35.8798+0.7)} = \boxed{8.505}$

$8.505 = \sqrt{\frac{L_1}{L_2}} \qquad L_2 = 1\ mH$

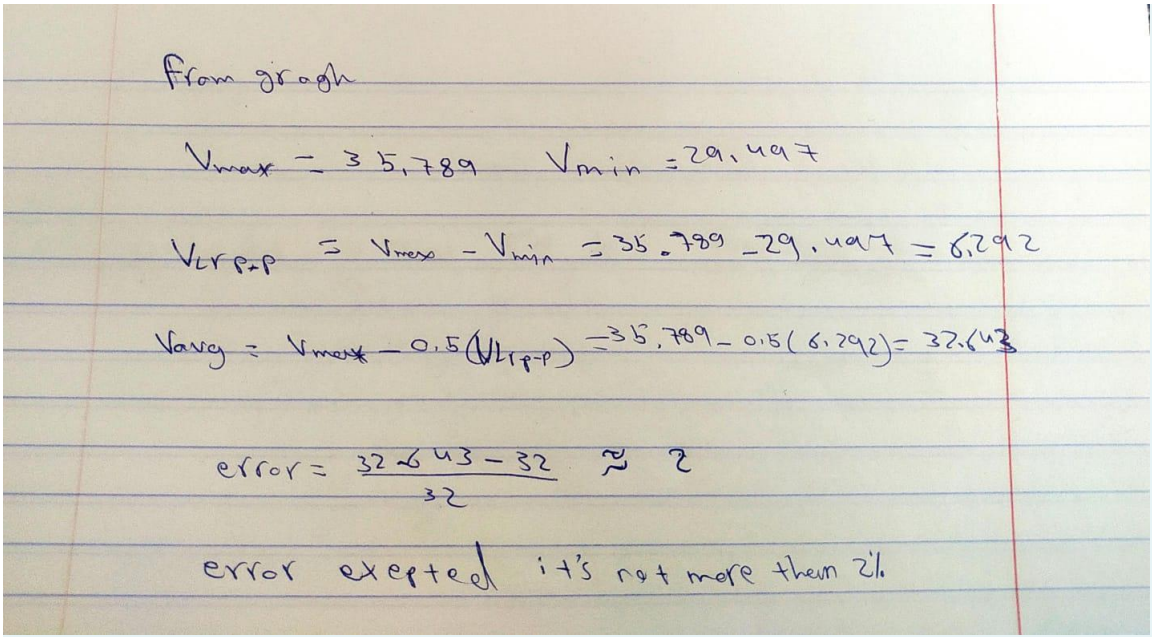
$L_1 = (8.505)^2 \times 1\ mH = 72.341\ mH$



Simulation results



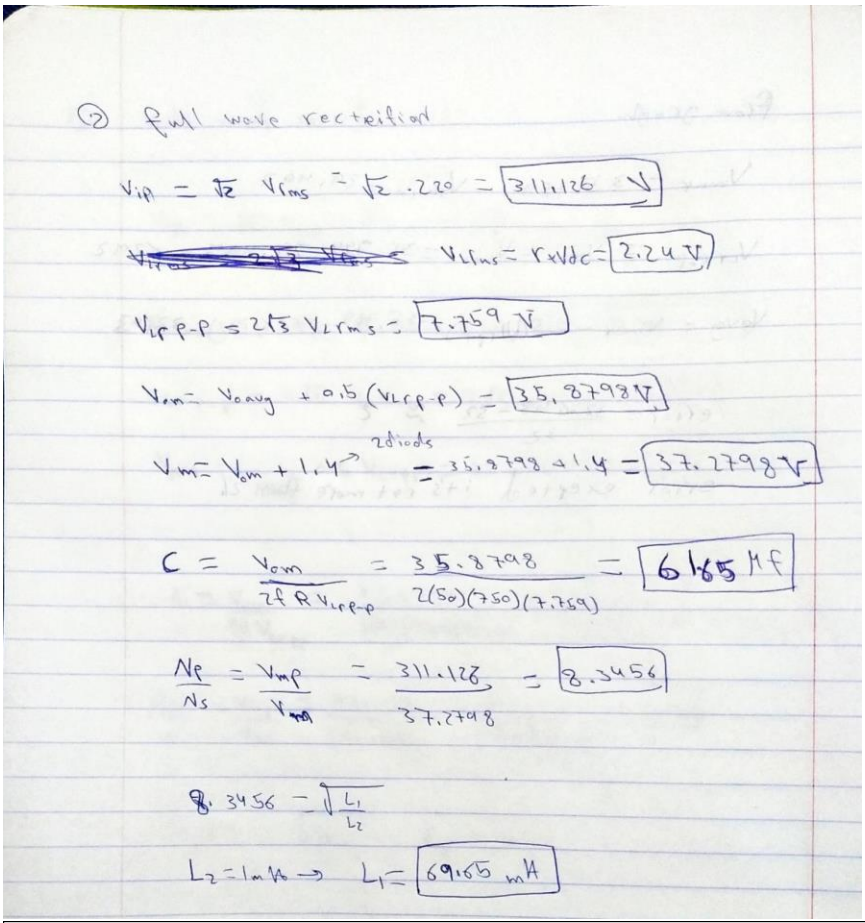
Comparison



The values were realistic to the calculations on paper

2. Bridge Full wave rectifier

Design and calculations



Full wave rectifier

$V_{ip} = \sqrt{2}\, V_{rms} = \sqrt{2} \cdot 220 = 311.126\ V$

$V_{Lrms} = r \times V_{dc} = 2.24\ V$

$V_{rp\text{-}p} = 2\sqrt{3}\, V_{Lrms} = 7.759\ V$

$V_{om} = V_{oavg} + 0.5\,(V_{rp\text{-}p}) = 35.8798\ V$

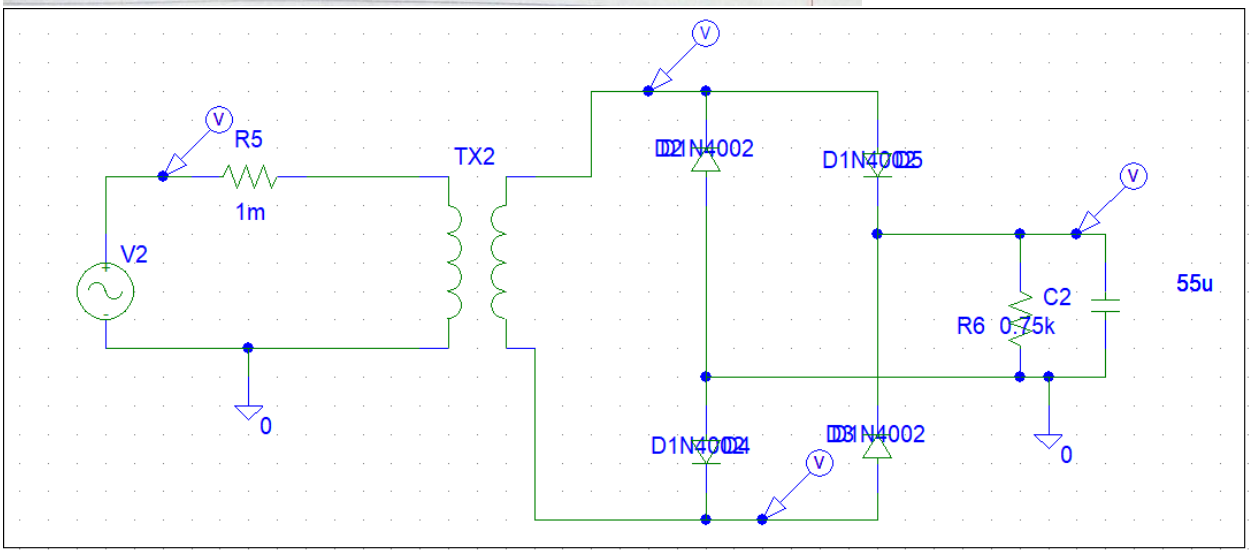
$V_m = V_{om} + 1.4 \xrightarrow{2\ diodes} = 35.8798 + 1.4 = 37.2798\ V$

$C = \frac{V_{om}}{2f R V_{rp\text{-}p}} = \frac{35.8798}{2(50)(750)(7.759)} = 61.85\ \mu f$

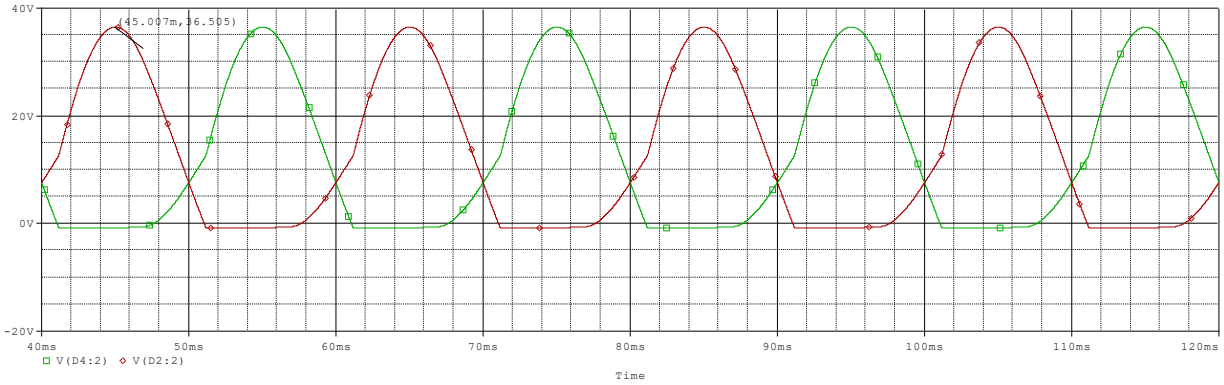
$\frac{N_p}{N_s} = \frac{V_{mp}}{V_m} = \frac{311.128}{37.2798} = 8.3456$

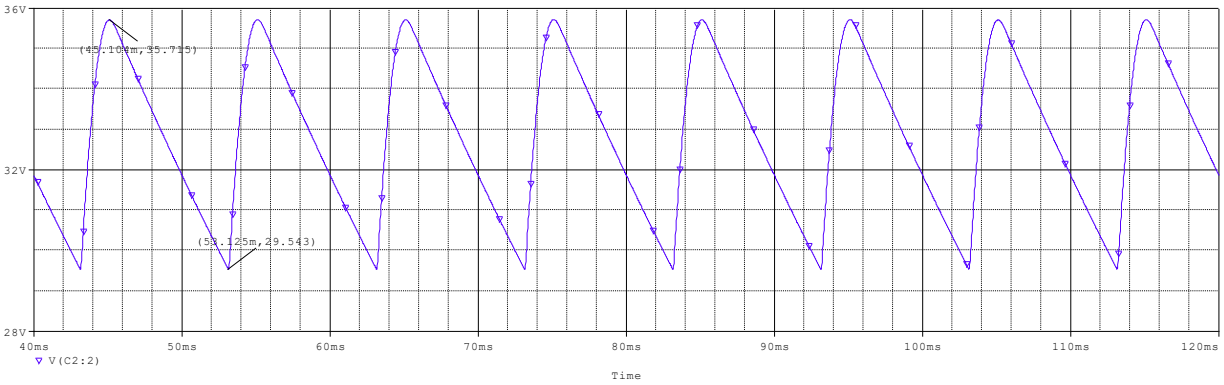
$8.3456 = \sqrt{\frac{L_1}{L_2}}$

$L_2 = 1\ mH \rightarrow L_1 = 69.65\ mH$

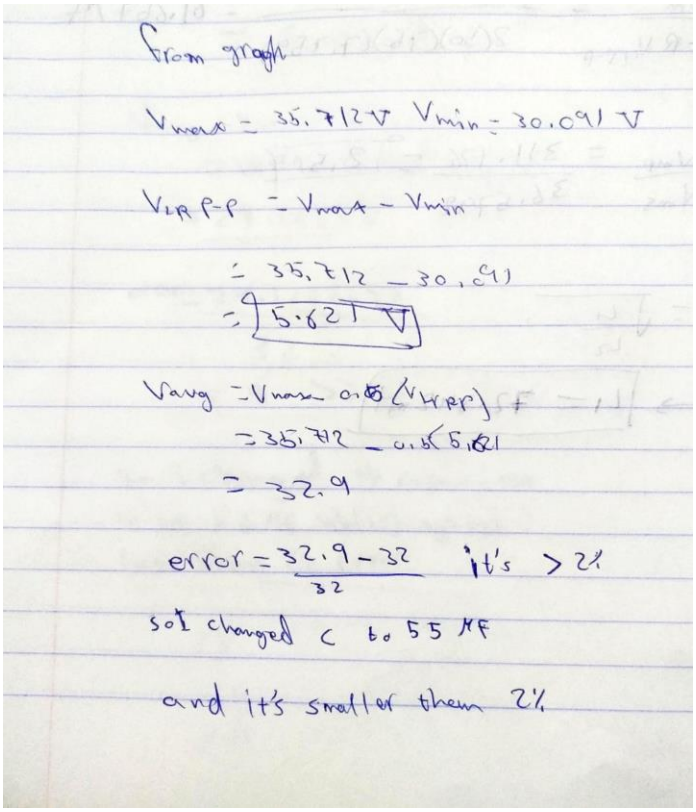


Simulation results





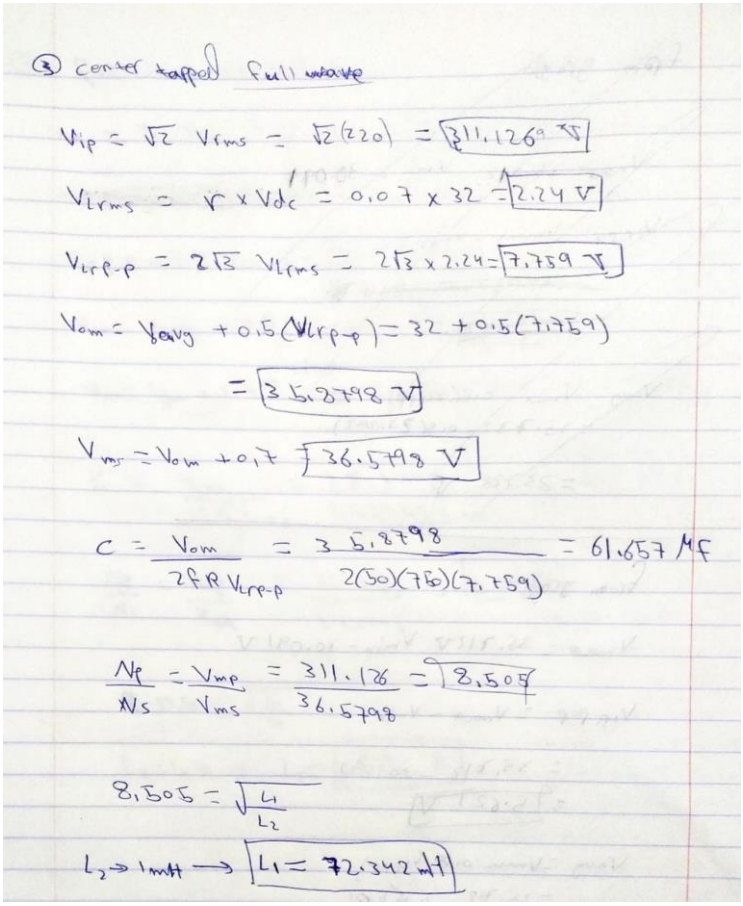
Comparison

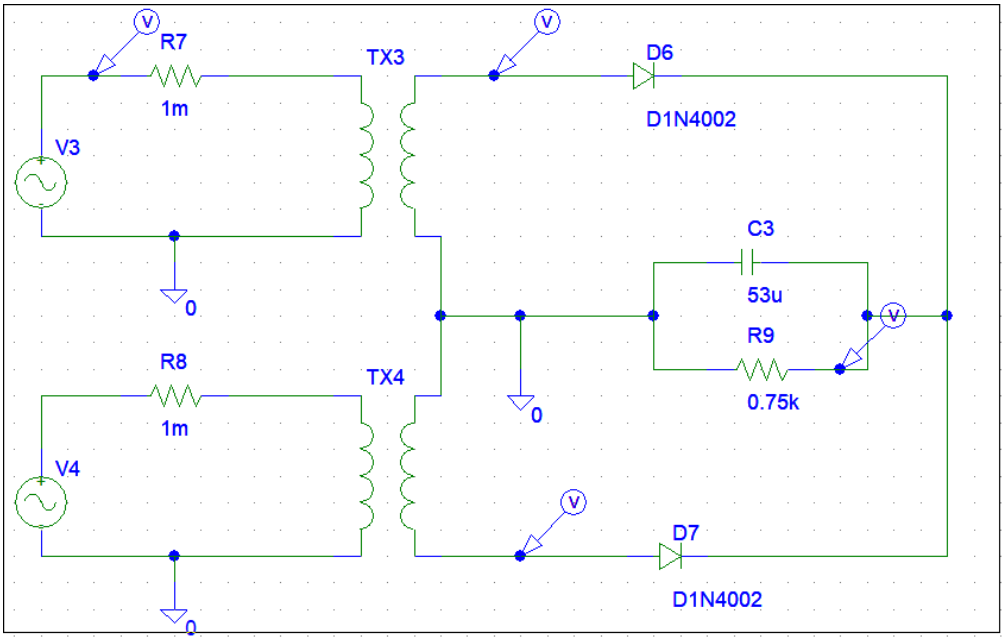


The values were a bit far (more than 2% error) so I changed the capacitor value to 55 MF to fit it and got realistic values to results on paper

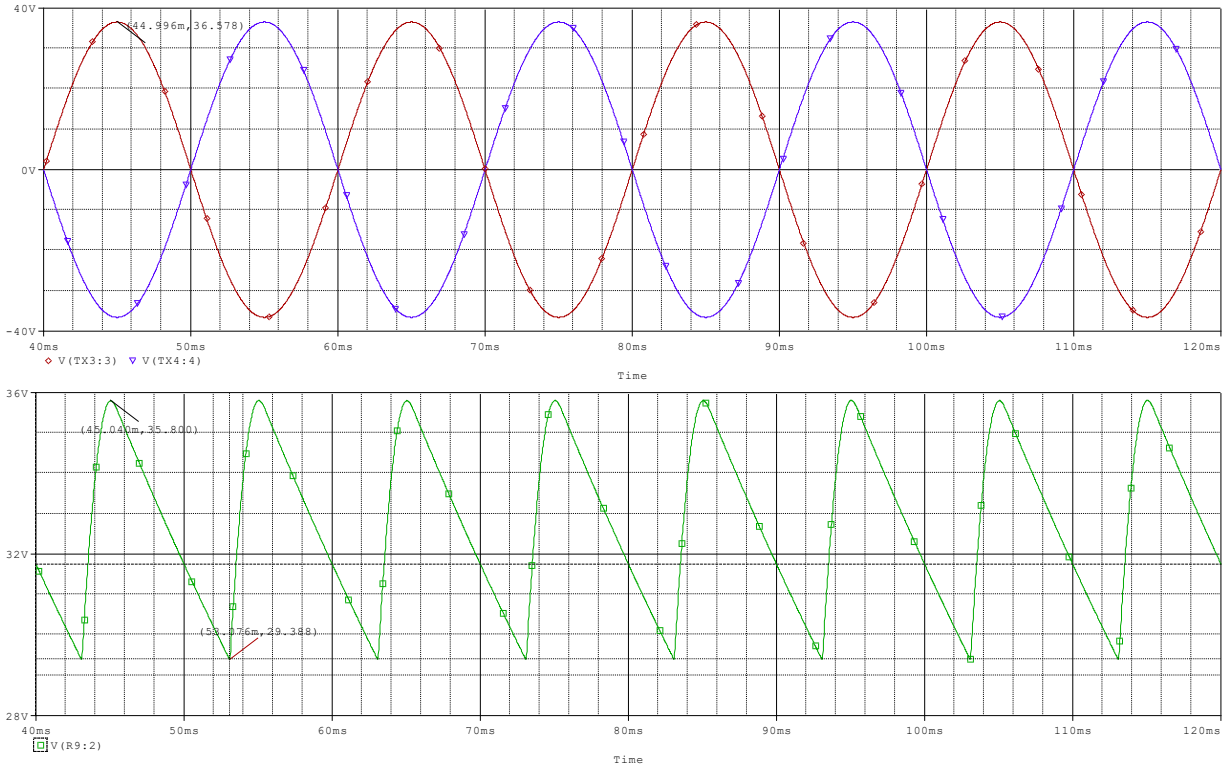
3. Center tapped transformer full wave rectifier

Design and calculations

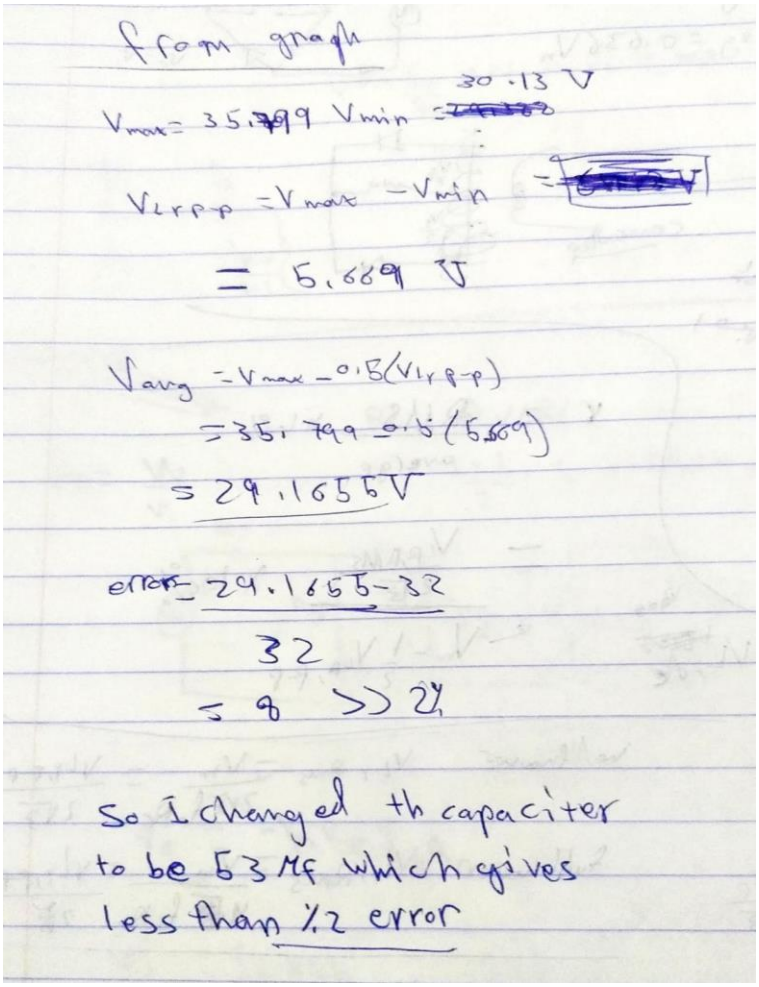




Simulation results



Comparison



I got the same problem in the previous circuit and fix it by changing the capacitor value to 53MF to get realistic data to ones on paper

Conclusion

All the 3 circuits show us how the rectifier works by changing the values form AC to a DC static value. in this assignment we make 3 circuits, half wave, full wave and center tapped full wav rectifier I made some calculations on paper and designed them on PSpice and compared the results.