2.

a.

According to given values, duty cycle (D) range is 0.25 - 0.6875. This range is found using the equation AA. The converter should be operating in CCM operation between this duty range.

AA

And using the given constant output voltage and rated output power in equation BB, the output current is found to be 1A.

BB

In order to find **minimum** inductance that would keep de converter operating in CCM operation, the output current should be equal to output boundary current value (equation. It cannot directly found from the maximum boundary current value (equation X2) since all values in D range (0.25 – 0.6875) should be ensured but in equation X2, D = 1/3.

X1

X2

The possible L range with respect to found data is 1.79 – 3.95 µH. If 1.79 µH (i.e. minimum value of the possible inductor range) is chosen, the converter cannot operate in CCM operation mode when duty cycle is below 0.6875. In order to converter operate in CCM operation mode under given all circumstances, **L should be chosen as 3.9** µH, considering all the values in D range**.**

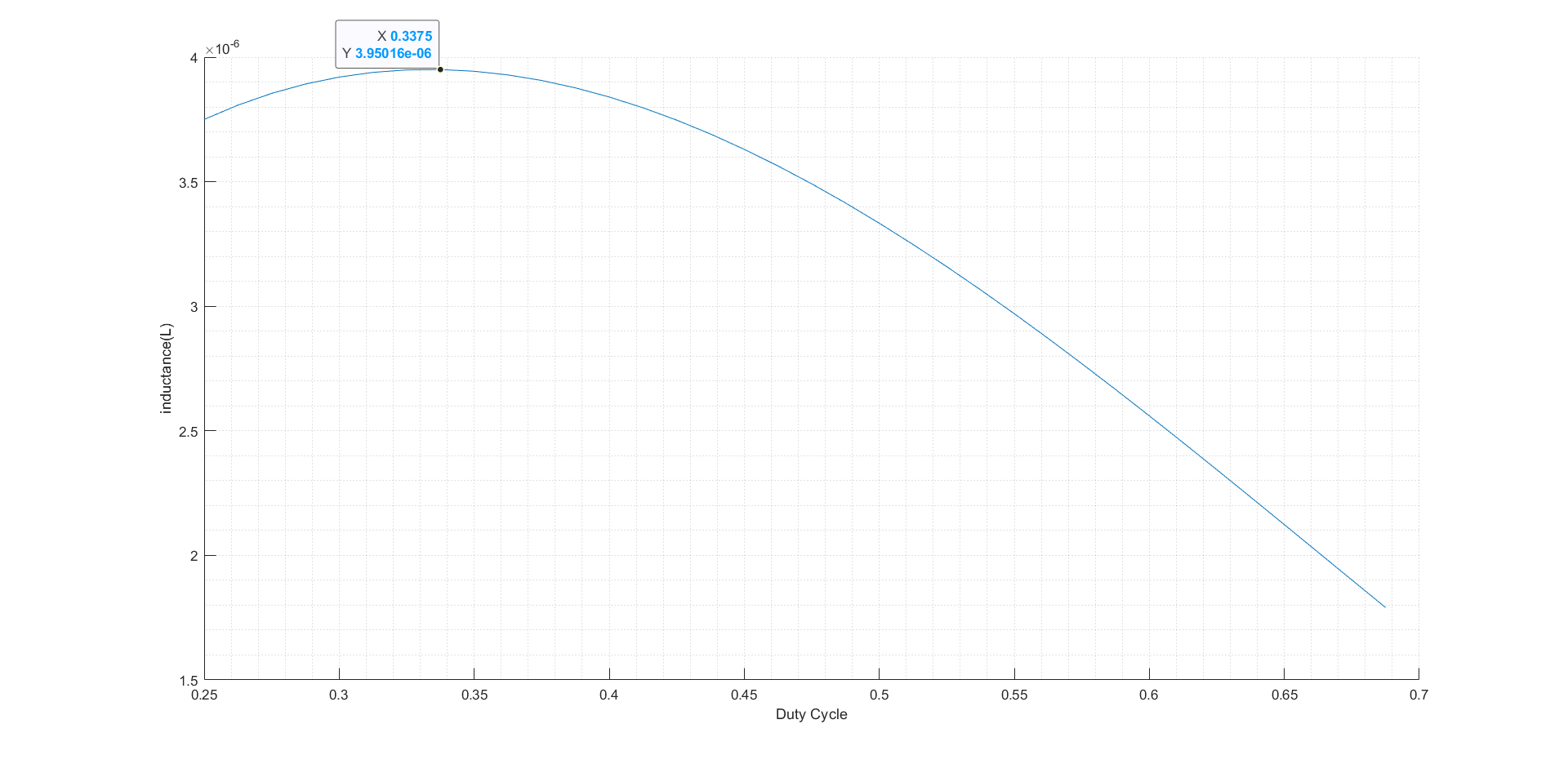
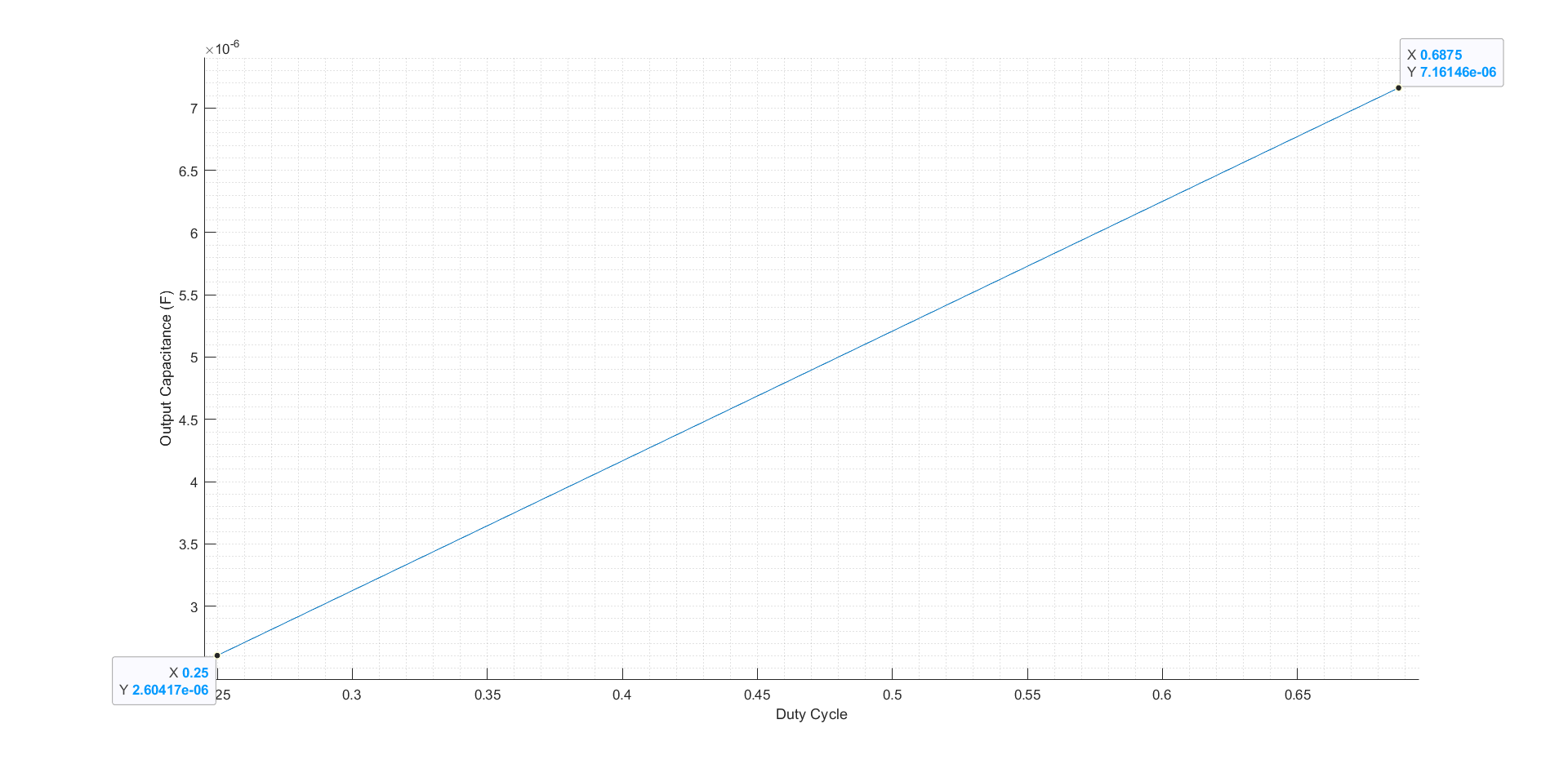


Figure X. Duty cycle vs Inductance

b.

Output capacitance for peak-to-peak voltage ripple less than 2% can be calculated by using the equation YY where and .

The connection between duty cycle and output capacitance can be observed in figure X. Output capacitance should be chosen as 7.16146 µF for voltage ripple smaller than 2% for all values of duty cycle.



*Figure X. Duty Cycle vs Output Capacitance*

c.

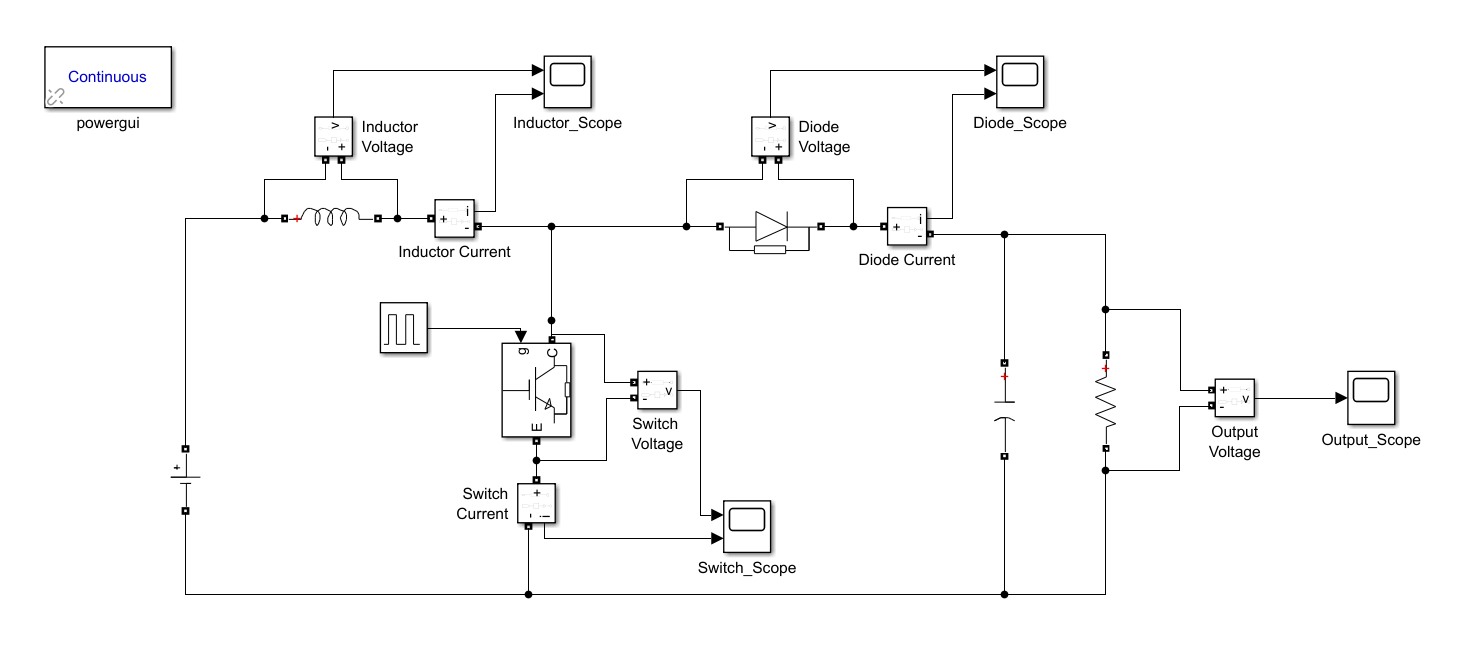
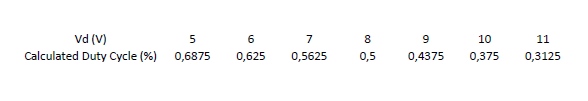


Figure XX. Boost Converter Circuit Design for Part 2.c

Considering the constant output and varying input voltage, a duty cycle range is calculated using the equation AA. The results can be seen in figure ZZ.



*Figure ZZ.* *Varying Input Voltages and Respective Duty Cycles*

But those calculations are made under the assumption that components are ideal. Even though simulation is designed to converge to ideal, there are still some nonidealities that causes approximately 5% duty cycle deflection.