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Simulation of Flyback Converter in MATLAB with and Without the Use of Input Filter

Saqib Asgar Kanth, Baziga Youssuf

Abstract: ***Flyback converter belongs to a category of converters with isolation. This paper presents a simplest approach to simulate single phase AC-DC Flyback Converter with and without filter. The use of LC filter reduces the input frequency harmonics and the Total Harmonic Distortion (THD) is analyzed. The Flyback converter is used to step up the input voltage by varying the duty cycle. The use of Flyback Converter is preferred because of the simpler design and lesser number of components and simpler control strategy. This paper deals with the closed loop simulation of a Flyback converter and its THD analysis in MATLAB.***

Keywords: Duty Cycle., Flyback converter, LC filter, THD.

I. INTRODUCTION

A number of converters are formulated in the past few years, depending upon the requirement. Converters can be categorized as isolated and non-isolated. Non-isolated converters are categorized as buck, boost, buck-boost etc. The isolated converters are categorized as forward, flyback converter etc. The modern technology continuously looks for better, simpler and efficient converter that provides regulation of the output voltage. All of the above specifications is not possible in a single converter topology, so a tradeoff has to be done between the specifications depending upon the requirement. [1]

Flyback Converter is a converter topology that provides isolation between the input and the output side and provides output voltage regulation. The major advantages of the flyback converter include simpler structure, isolation and simpler control strategy because of the above advantages the Flyback converter has become popular for SMPS circuits. [2]. The output voltage of a Flyback converter is given by:

$$\frac{Vo}{Vd} = \frac{N2}{N1}\frac{D}{1-D}$$

It is evident from the above equation that the output voltage can be stepped up or down using either the duty cycle or the turns ratio of the flyback transformer. Increasing the output voltage only by the use of duty cycle e.g. as in case of buck-boost converter increased the stress over switches but using Flyback converter the stress over the switches can be reduced by increasing the output voltage using turns ratio as well.

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The main features of Flyback converters are:

- Lesser no of components therefore reduced cost (absence of output inductor)
- Isolation property (Flyback transformer)
- Multiple outputs.

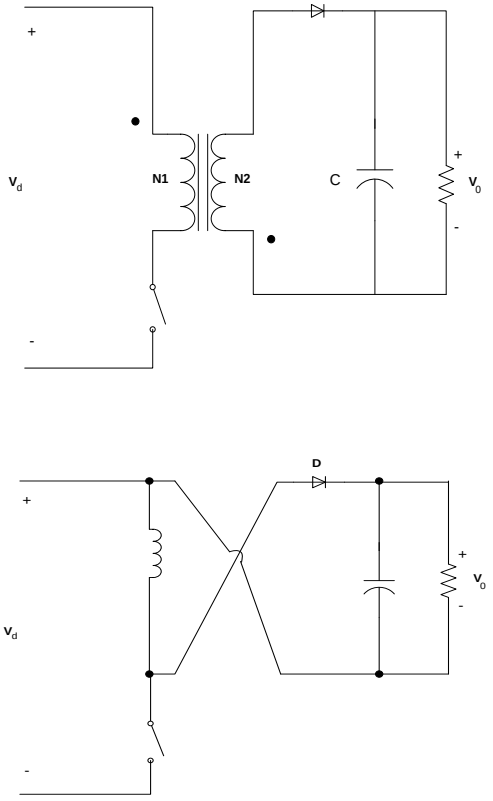

Fig 1. Circuit Topology

II. SYSTEM SPECIFICATIONS

Table I. Parameters of Implementation Circuit Without the use of Filter [1,3]

Parameter Description	Abbreviation	Value
Input Voltage	V_{ac}	100 V
Output Voltage	V_o	200 V
Power	P	100 W
Switching Frequency	f_s	50 KHz
Output Capacitor	C_o	0.5 µF
Magnetizing Inductance	L_m	2 µH
Primary Inductance	L_p	0.62 µH
Secondary Inductance	L_s	1.6 µH

Table II. Parameters of Implementation Circuit with the use of Filter [1,3]

Parameter Description	Abbreviation	Value
Input Voltage	V_{ac}	100 V
Output Voltage	V_o	200 V
Power	P	100 W
Switching Frequency	f_s	50 KHz
Filter Capacitor	C_1	3.1 µF
Filter Inductor	L_1	0.1 µH
Output Capacitor	C_o	1.56 mF
Magnetizing Inductance	L_m	100 µH
Primary Inductance	L_p	0.011 µH
Secondary Inductance	L_s	0.5 µH

III. SIMULATION

A. Simulink model of Flyback converter without filter

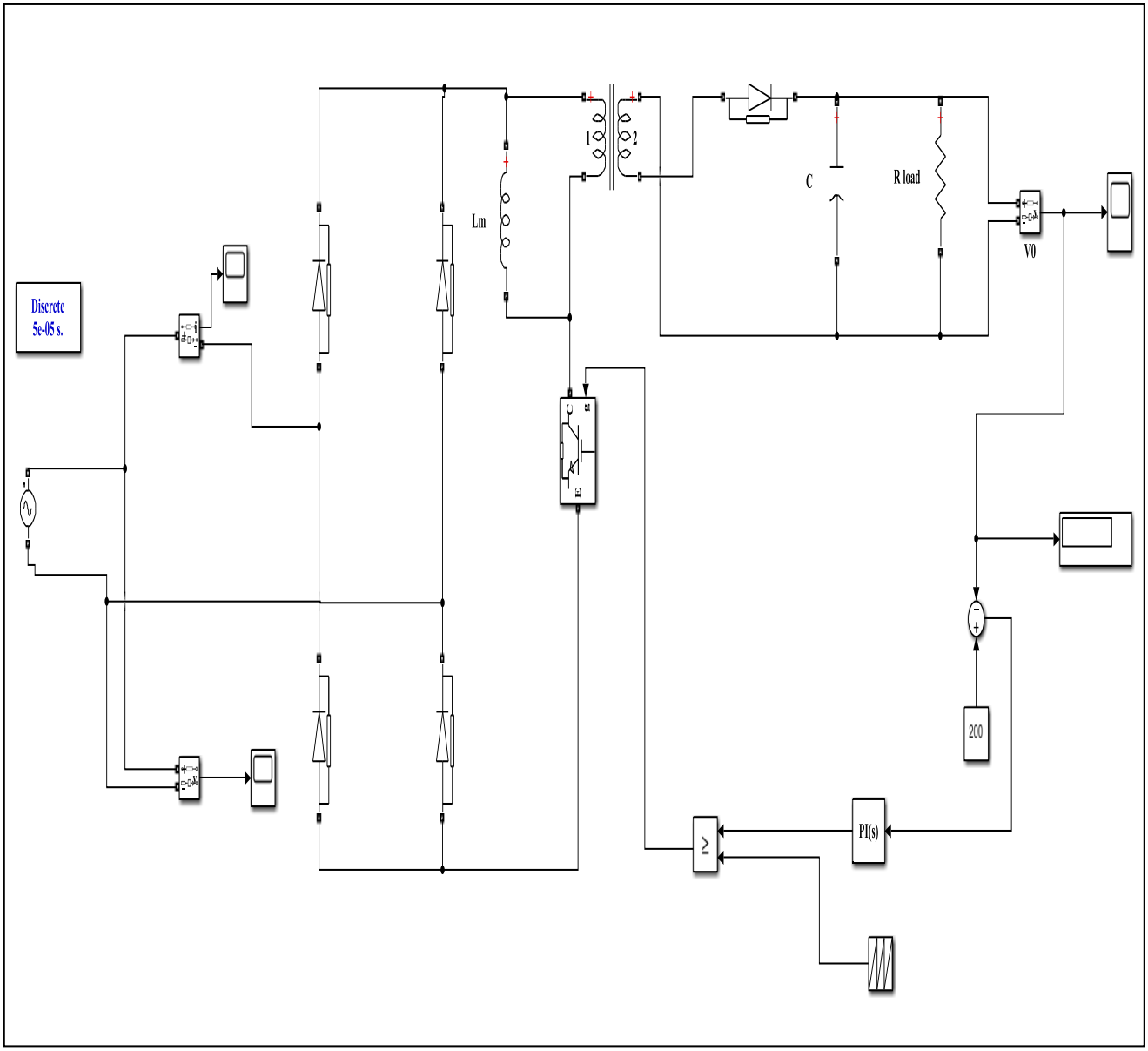

Fig 2. Flyback converter without filter

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B. Simulink model of Flyback converter with filter

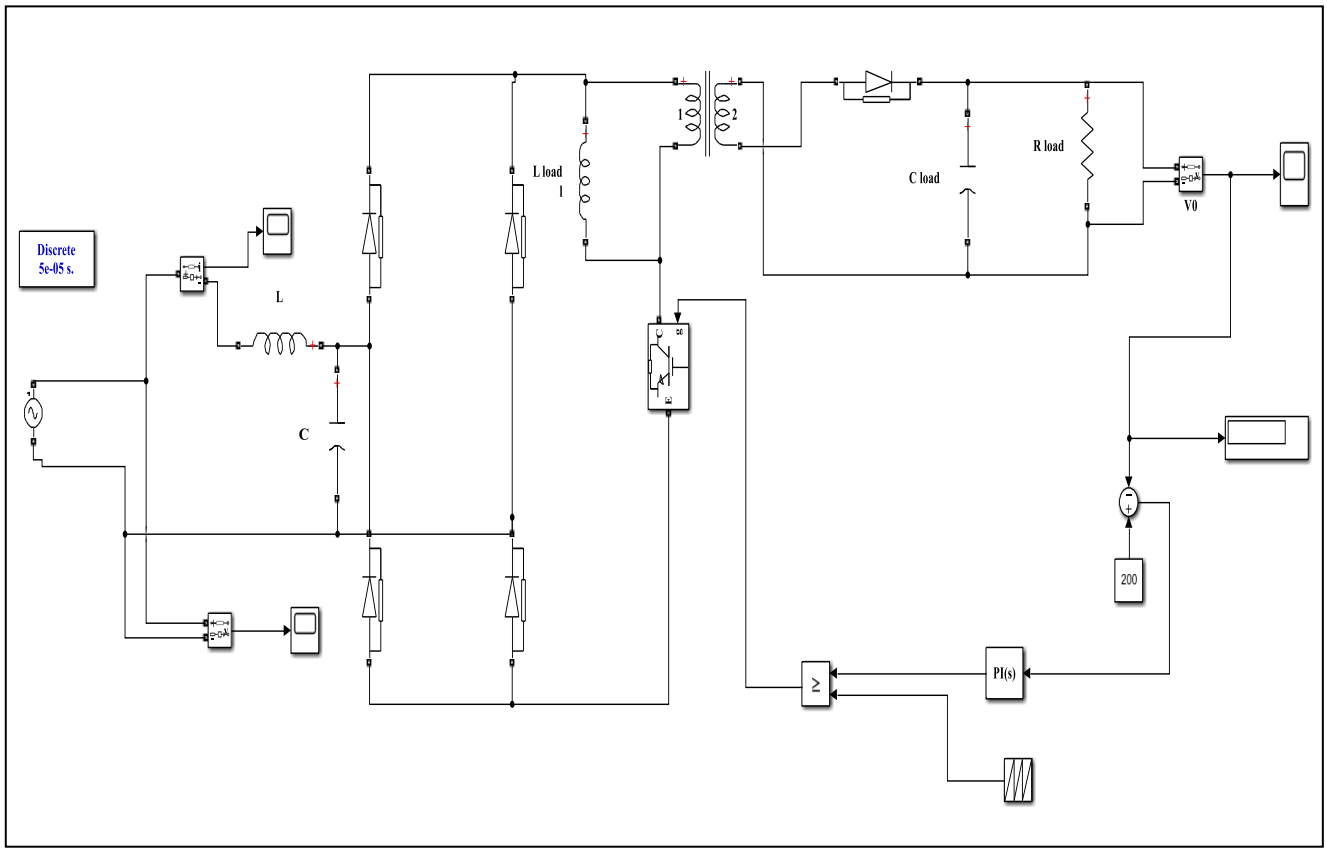

Fig 3. Flyback converter with filter

IV. RESULTS

A. Simulink Results of Flyback converter without filter

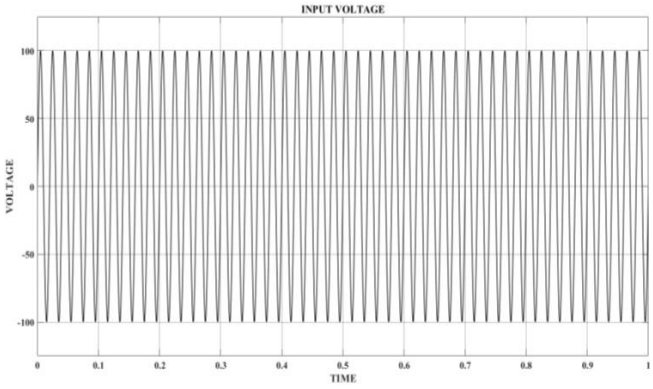

Fig 4. Flyback converter input voltage

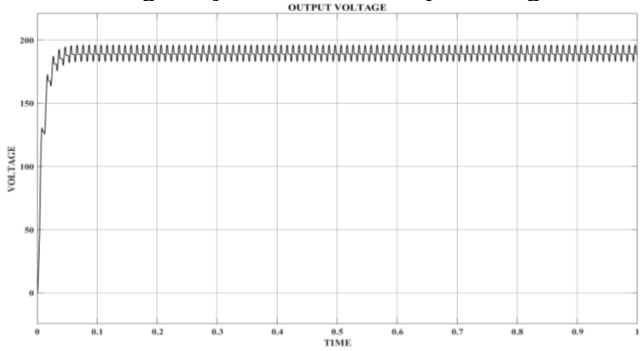

Fig 5. Flyback converter output voltage

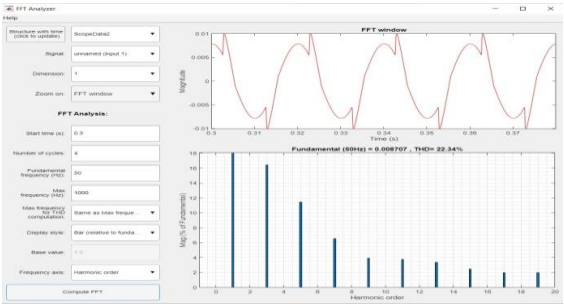

Fig 6. Display selected signal and FFT analysis i. e. THD analysis (bar relative to fundamental)

B. Simulink Results of Flyback converter with filter

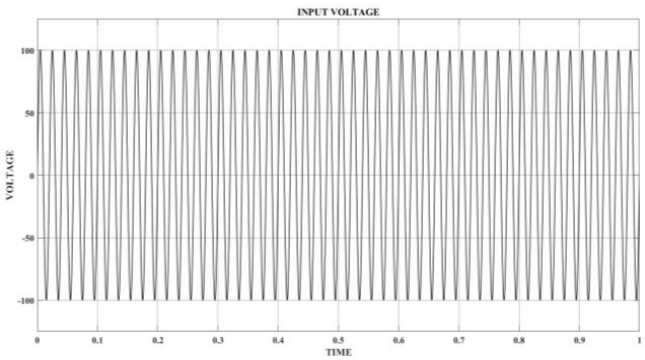

Fig 7. Flyback converter input voltage

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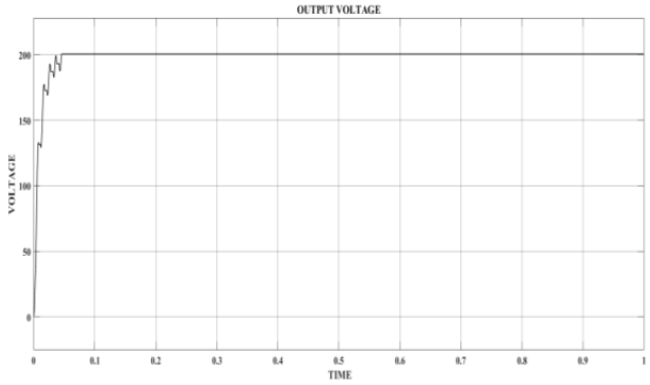

Fig 8. Flyback converter output voltage

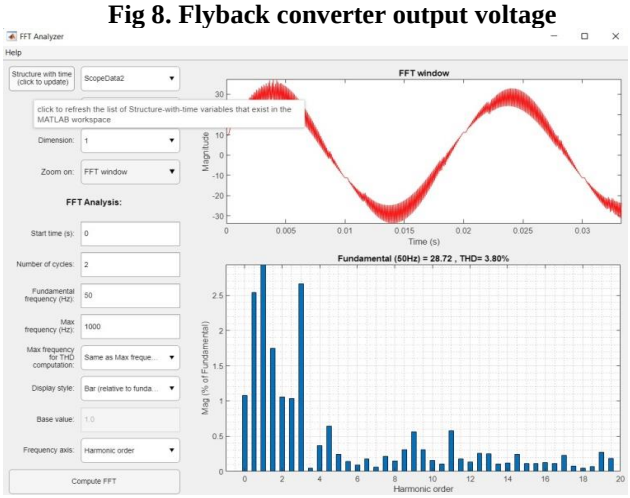

Fig 9. Display selected signal and FFT analysis i.e. THD analysis (bar relative to fundamental)

V. CONCLUSION

From the MATLAB Simulink model of close loop Flyback converter, it is easily noticed that the response is much reliable in closed loop along with the use of filter The oscillations are removed from the system response and the THD was found to be 22.34 % in case of Flyback converter without filter, while in case of Flyback converter with the use of filter THD was found to be 3.80% that is within permissible limits.

REFERENCES

1. Nisha Kasundra, Ankit Kumar, "Design and Simulation of Flyback Converter in MATLAB using PID Controller", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 2, February 2016, pp. 960-965.
2. Nasir Coruh, Satilmis Urgun, Tarik Erfidan, "Design and Implementation of Flyback Converters", 2010 5th IEEE Conference on Industrial Electronics and Applications, pp.1189- 1193. [CrossRef]
3. P. Suskis, I. Galkin, Member, J. Zakis, Member, "Design and Implementation of Flyback MPPT Converter for PV-applications".

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Saqib Asgar Kanth is an engineering graduate specialized in Electrical Engineering. He received the B.Tech degree from Islamic University of Science and Technology, Awantipora, Jammu and Kashmir, India in 2022. His fields of interests include simulation of power systems, switching mode power converters and Photovoltaic energy sources.

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