Modelling of DC/DC Boost Converter in Visual Programing Environments

Gergana Vacheva[1)], Nikolay Hinov[1)], and Zoran Zlatev[1)]

[1)] Department of Power Electronics,
Technical University of Sofia, Sofia, Bulgaria,
gergana_vacheva@tu-sofia.bg

***Abstract**: The boost converter are the most commonly used DC/DC converters, especially for automotive applications, power amplifier applications, adaptive control applications, battery power systems, consumer electronics and communication applications. This is because the battery charge requires high DC voltage to be fully charged. The main object of the research in the current paper is to examine the operation of the boost converter in visual programing environments like Matlab and LabVIEW. A mathematical model of the converter and its parameters are presented. The simulation results states that Matlab/Simulink is a suitable platform for control and regulation of the simulation processes, in additional to its dominant role in conducting research tasks. Similarly, LabVIEW software provides the possibility to be used for application that requires test, measurement and control with rapid access to hardware and data insights.*

1. INTRODUCTION

There are several requirements for the necessity of examination to the mathematical model of the boost converter in different visual programming environments [1−3]. The basic problem is keeping the output voltage in the specified voltage interval. Here is presented the main difficulties:

- Changing of the properties of some of the components in the converter
- Changing of the converter topology
- Changing of the controller
- Increasing of the number of signals that are measured and used by the controller.

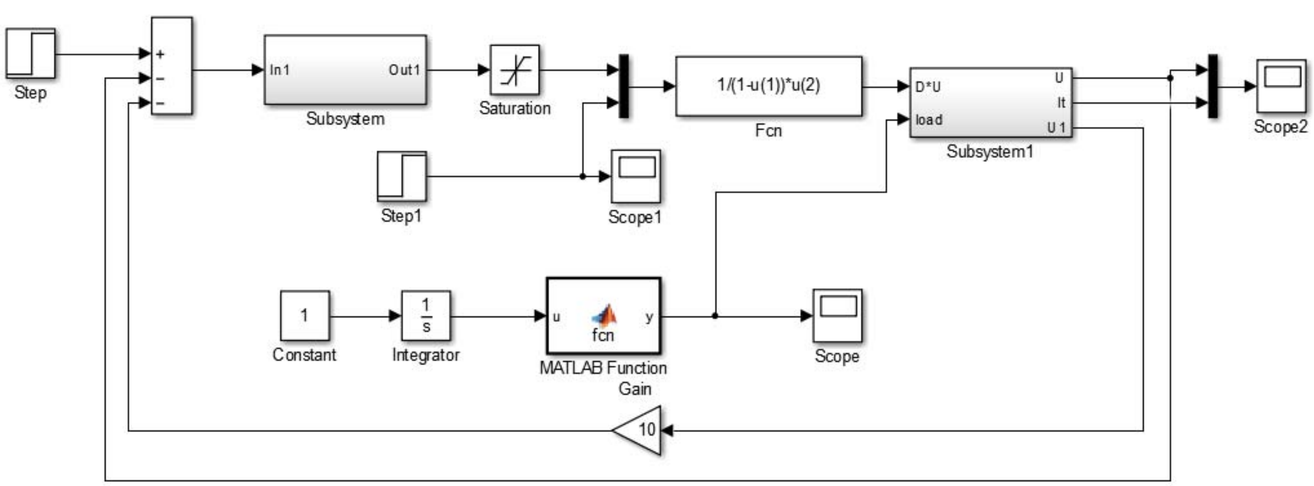

Fig. 1. Scheme of boost converter in LabVIEW

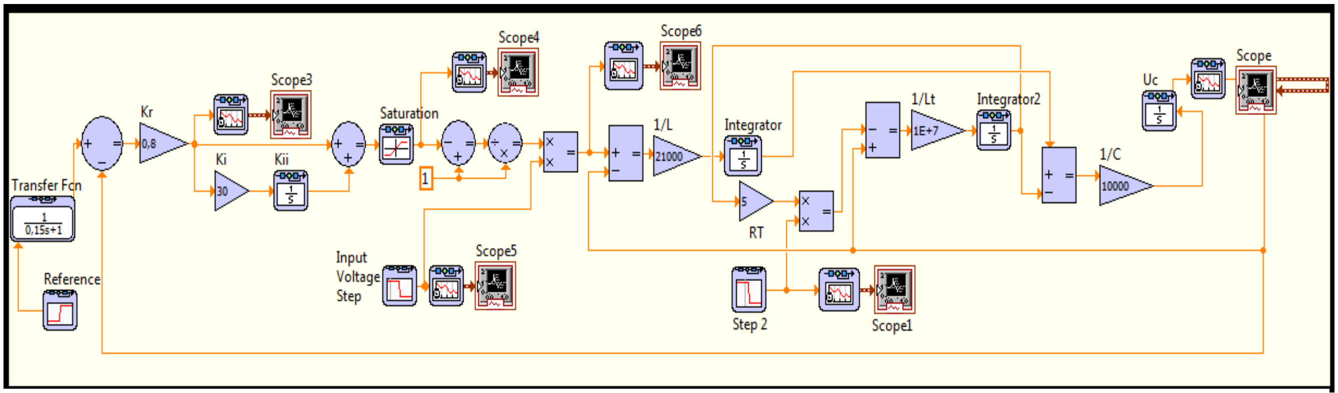

Fig. 2. Scheme of boost converter in LabVIEW

2. Model of Boost Converter

At Fig. 1 is visualized the scheme of the examined boost converter with proportional-integral (PI) regulator in Matlab/Simulink. The parameters of the used controller are selected by means of Ziegler-Nichols method. For this research is used classical scheme of boost converter. In the current paper will be examined the process of the DC/DC converter also in LabVIEW at Fig. 2.

2.1. Mathematical model

The following system of differential equations describes the mathematical model of the boost converter:

$$L\frac{di_L}{dt}+U_C=\frac{1}{1-D}U_i \qquad (1)$$

$$i_T R_T + L_T\frac{di_T}{dt}=U_C \qquad (2)$$

$$i_L + i_T = C\frac{dU_i}{dt} \qquad (3)$$

Where i_L is the current through the inductance L, i_T is the current through the load RT and LT, UC is the voltage of the capacitor C, D is the duty cycle.

The used variables and their values are presented in Table 1.

Variables (Indication)	Values
Capacitor (C)	$100*10^{-6}$ [F]
Inductance (L)	$47*10^{-6}$ [F]
(Lt)	$0.1*10^{-6}$ [F]
Load (RT)	5 [Ω]
Input voltage	12 [V]
Proportional coefficient (kr)	0.8
Integral coefficient (ki)	30

3. Results

The obtained results are simulated in Matlab/Simulink and in LabVIEW and presented on Fig. 3 to Fig. 7 respectively.

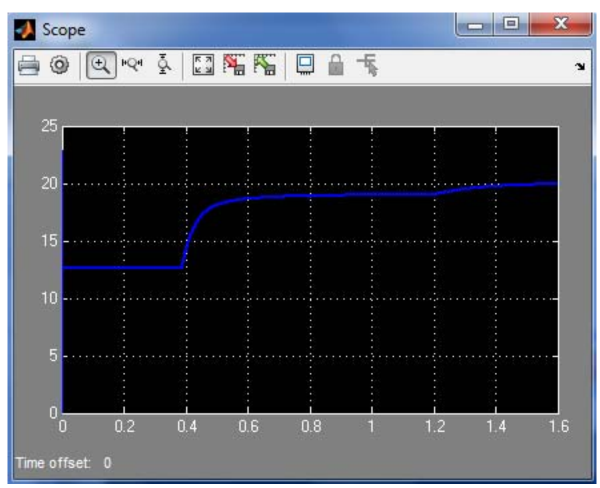

Fig. 3. The output voltage in Matlab/Simulink

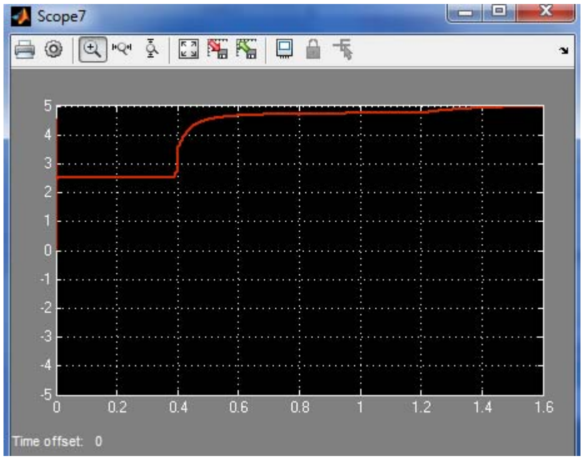

Fig. 4. Load current in Matlab/Simulink

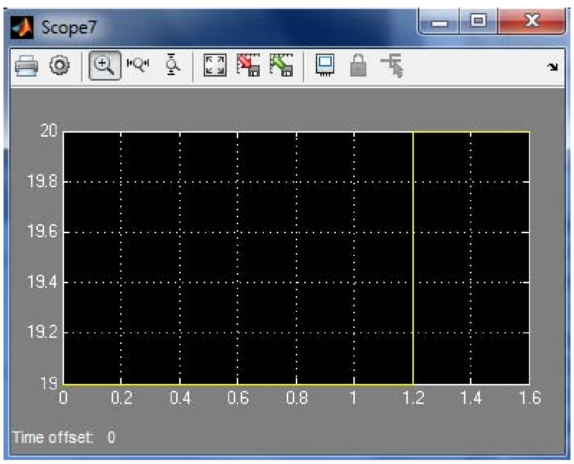

Fig. 5. Changing of the reference from 19 V to 20 V

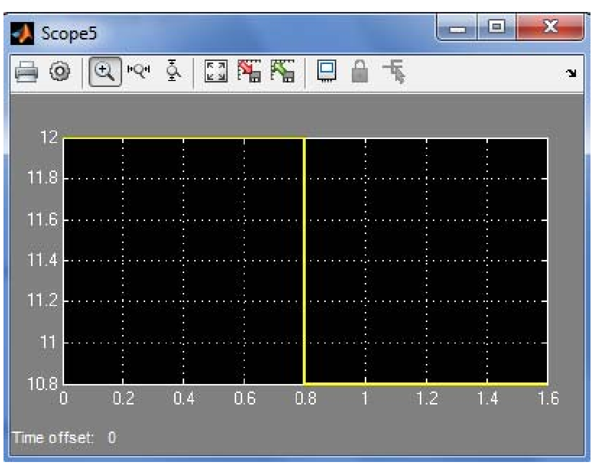

Fig. 6. Changing of the input voltage

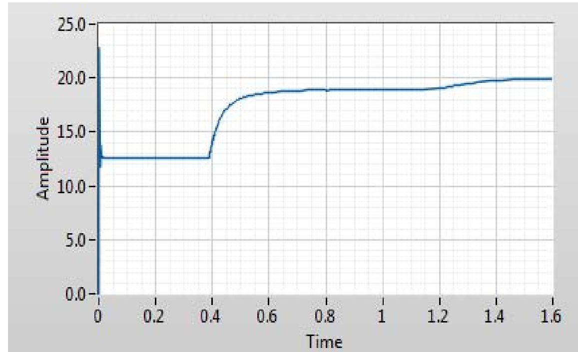

Fig. 7. Output voltage in LabVIEW

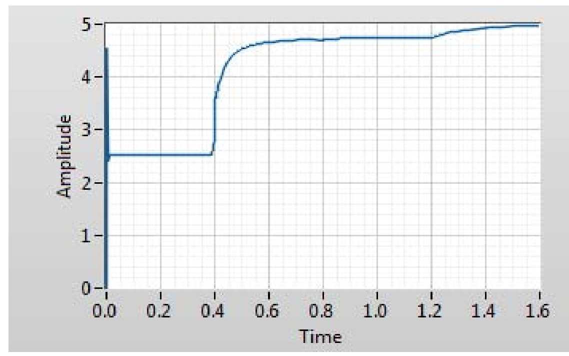

Fig. 8. Load current in LabVIEW

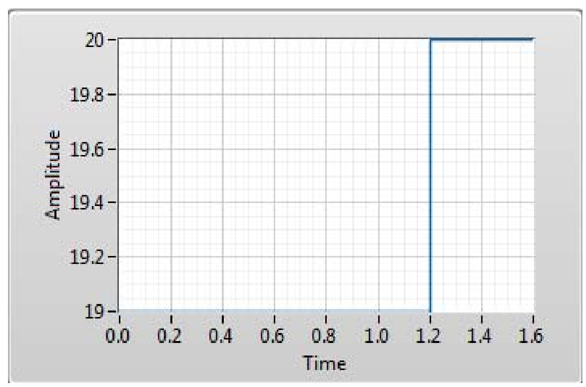

Fig. 9. Changing of the reference from 19 V to 20 V

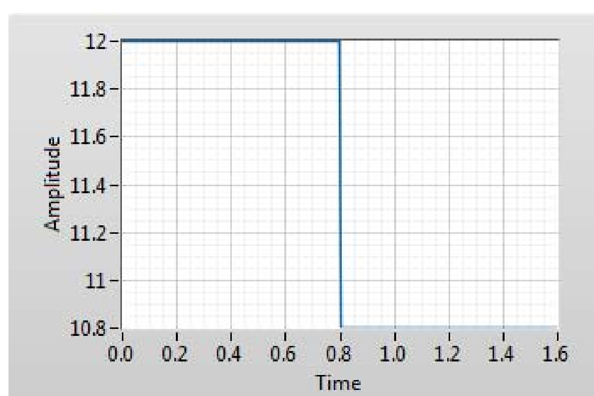

Fig. 10. Changing of the input voltage

4. CONCLUSION

In the current paper a modelling of a DC/DC boost converter is presented. A mathematical model in Matlab/Simulink and LabVIEW is realized. A comparison between two different software is realized. The obtained results from simulations confirm the appropriate work of the proposed mathematical model.

The depict model could be useful for multiple applications like personal electronics, automotive industry, photovoltaic systems and communication. In further researches the developed model could be apply for studying of photovoltaic systems for provide electric supply in micro and nanogrid.

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