Simulation model of PID for DC-DC converter by using MATLAB

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ABSTRACT

The change in loads in most applications whose source of nutrition is a renewable energy system. Renewable energy systems can change according to climatic conditions. To control and control these changes, the use of conventional control systems such as PIDs. The PID is one of the most common and used conventional control systems that have been chosen to output the type of power electronic devise (DC-DC converter) in different working conditions. The current study aims to improve the system performance through simulation. Simulation results demonstrate the effectiveness of the system with the controller based on setting parameters such as recording system states, embedded elevation time and transient response.

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1. INTRODUCTION

Electronic power devices used in the industry work to convert energy fertile need from direct current to another. The same type may be a constant current with a change in its value and it is called DC-DC, which is one of the four types of electronic power devices. Other types include another conversion of the same type of alternating current called AC-AC and the other two types, which is an alternating conversion to a continuous AC-DC or continuous to an alternating DC-AC, and it is called an inverter [1]-[5]. Power electronic devise (DC-DC converter) that convert, for example a specific electrical level of voltage to another had called constant current transformers [6]-[8]. Power electronic devise (DC-DC converter) have used in many electronic systems [9]-[11] such as power generation systems, renewable energies, communication systems and in many industrial applications [12]-[14]. Power electronic devise (DC-DC converter) are small and possess high efficiency, which gave them high reliability for use in various fields [15]-[17]. PWM works to control the converter with the adoption of tuning for traditional control systems such as PI, PD or PID.

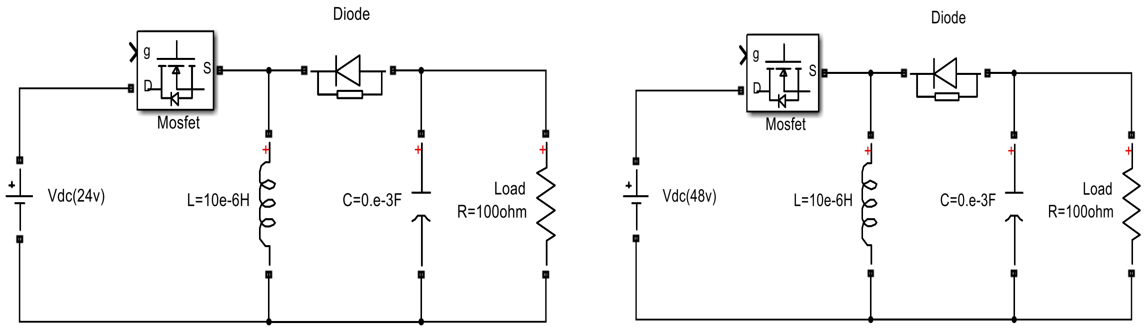
The current work provides how to develop a design for Buck boost adapter with PWM in addition to a control unit of the type PID [18]-[20]. PID is one of the most important traditional control systems that works to control and is widely used and noticeable in the industry as it is characterized by being simple and easy to implement and applicable [21]-[23]. PID provides acceptable performance with linear systems of the first degree, the process of controlling the controller have two tasks that include setting a simple and powerful algorithm it works under suitable conditions [24]-[26]. In this work, a study and implementation of simulator performance controller for power electronic devise (DC-DC converter) with different load and source. The current simulation is using the Matlab program, which previous studies have demonstrated the possibility of using to determine the response of electronic power systems. In addition to the use of traditional control systems represented by PID with PWM to address the instability of different cases within the design of the system to obtain the best model with high response and short time.

2. BUCK BOOST CONVERTER SIMULINK MODEL

Buck boost converter Simulink model for this system include, buck boost converter Simulink model and PID for PWM.

2.1. Buck boost converter modeling

The simulation model as shown in Figure 1, include Vdc (24 v, 48 v), Mosfet (Ron=0.1 ohm, Rd=0.01 ohm & Rs=100 kohm), diode (Ron=0.001 ohm, Vf=0.8 v, Rs=500 ohm & Cf=250 microF), inductor (L=10 microH), capastor (C=0.5 mF) and Load (R=100 ohm).

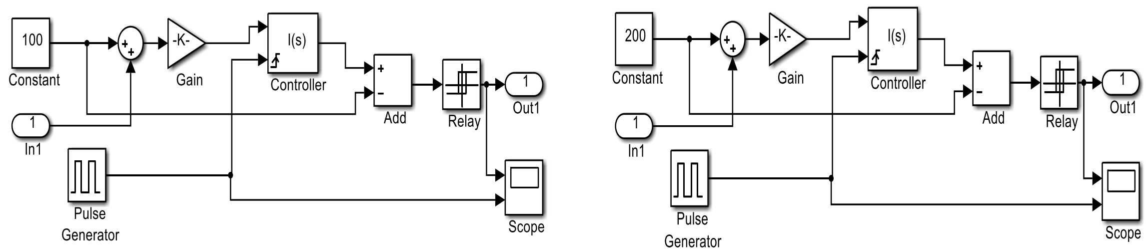


(a) (b)

Figure 1. The simulation model of EPTs, (a) I/p =24 vdc, (b) I/p =48 vdc

2.2. PID for PWM

The simulation model as shown in Figure 2, include PID and PWM constant (o/p voltage =100,200), Gain=(100,50), pulse (Amplitude=1, period=1/10000 & pulse width=50) and PID Controller (I= 40000).



(a) (b)

Figure 2. The simulation model PID for PWM, (a) o/p=200 vdc, (b) o/p=100 vdc

3. RESULTS AND DISCUSSION

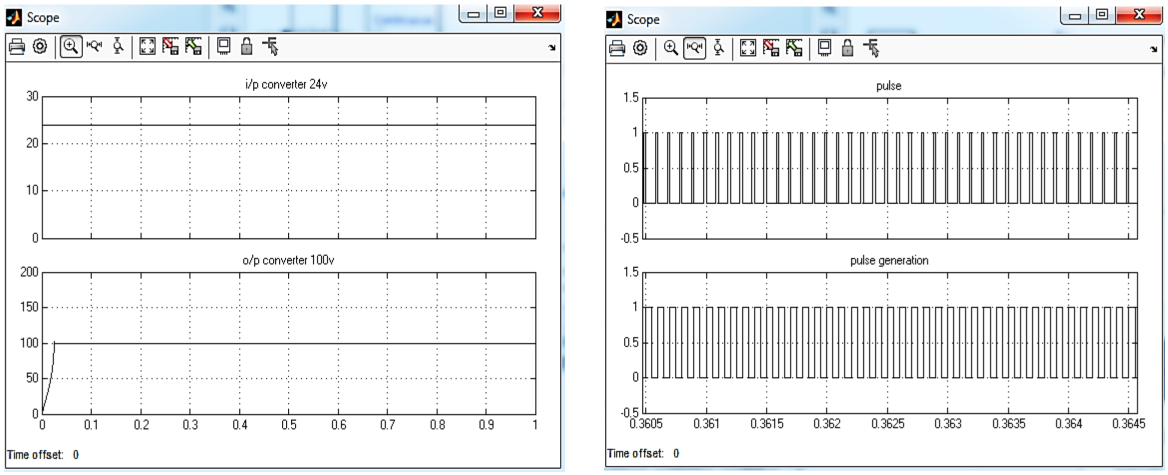
The simulation results had many parts: I/p (24 vdc to 100 vdc) o/p, I/p (24 vdc to 200 vdc) o/p, I/p (48 vdc to 100 vdc) o/p & I/p (48 vdc to 200 vdc) o/p at two types at Gain=50 &100:

3.1. I/p (24vdc to 100vdc) o/p at Gain=50 and Gain=100

By using the simulation model in Figure 1(a) and Figure 2(a) to get the results for this part. The simulation response as shown in Figures 3 and 4, included i/p, o/p, pulse &pulse generation:

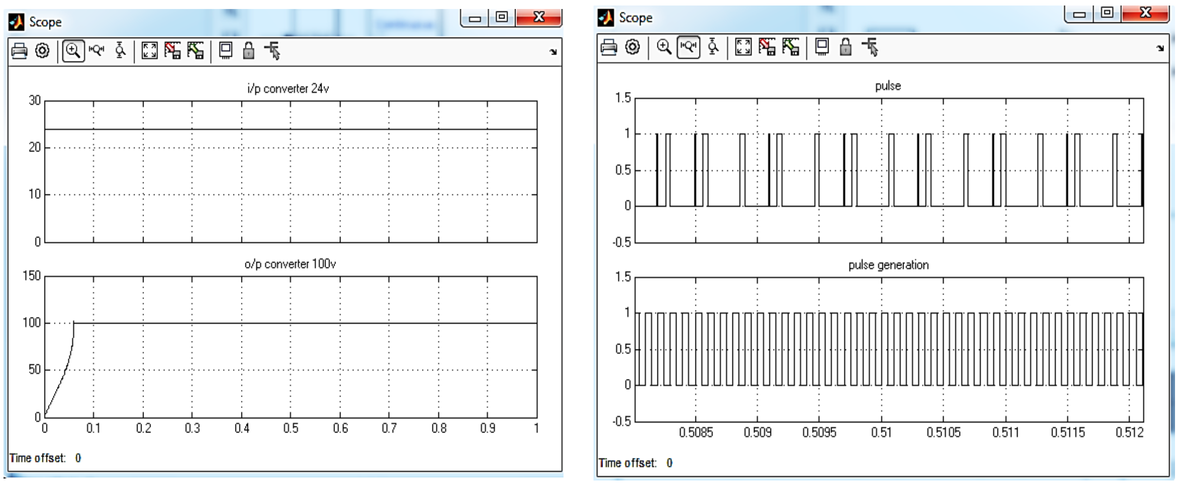
3.2. I/p (24vdc to 200vdc) o/p at Gain=50 and Gain=100

By using the simulation model in Figure 1(a) and Figure 2(b) to get the results for this part. The simulation response as shown in Figures 5 and 6, included i/p, o/p, pulse & pulse generation:



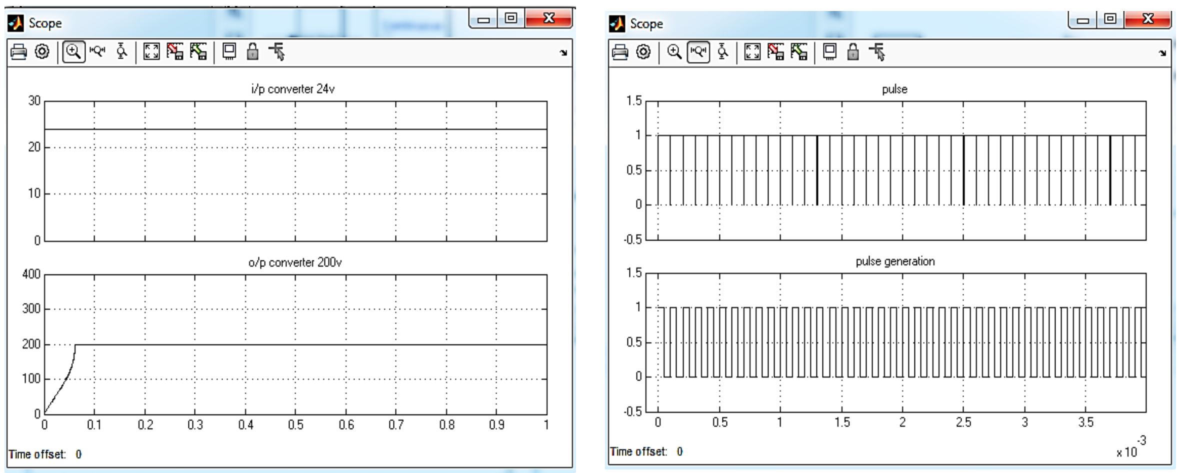
(a) (b)

Figure 3. Simulation response of 24 vdc to 100 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain 50



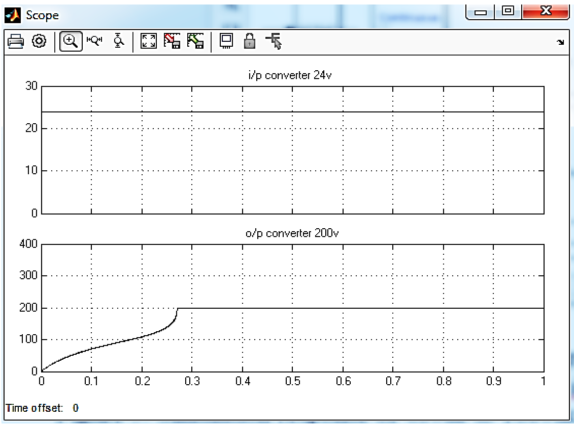
(a) (b)

Figure 4. Simulation response of 24 vdc to 100 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain 100

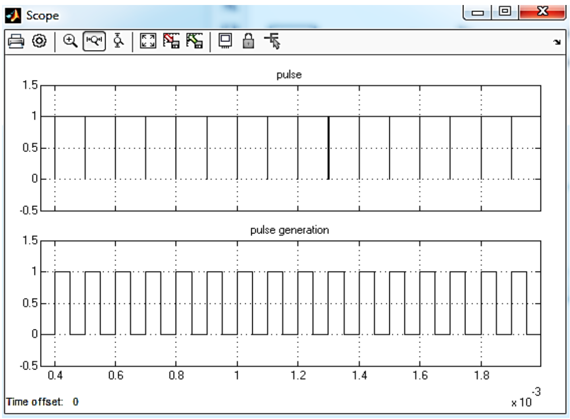


(a) (b)

Figure 5. Simulation response of 24 vdc to 200 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=50



(a)

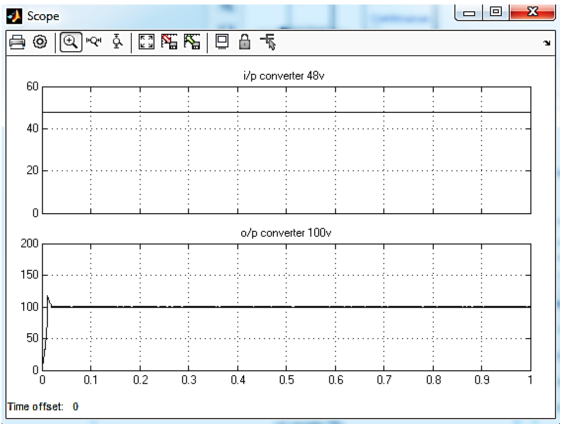


(b)

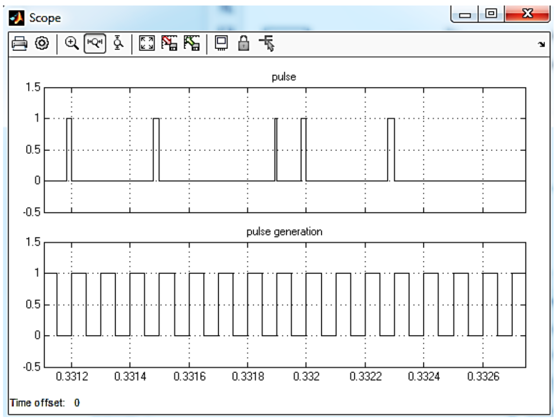
Figure 6. Simulation response of 24 vdc to 200 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=100

3.3. I/p (48vdc to 100vdc) o/p at Gain=50 and Gain=100

By using the simulation model in Figure 1(b) and Figure 2(a) to get the results for this part. The simulation response as shown in Figures 7 and 8, included i/p, o/p, pulse & pulse generation:

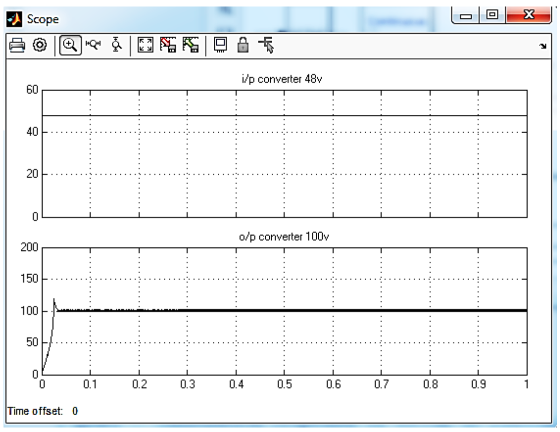


(a)

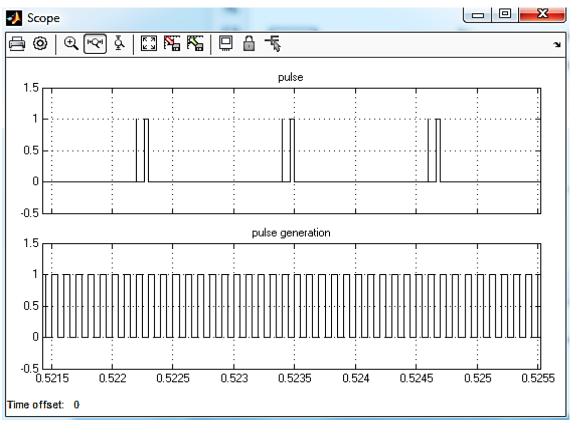


(b)

Figure 7. Simulation response of 48 vdc to 100 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=50



(a)

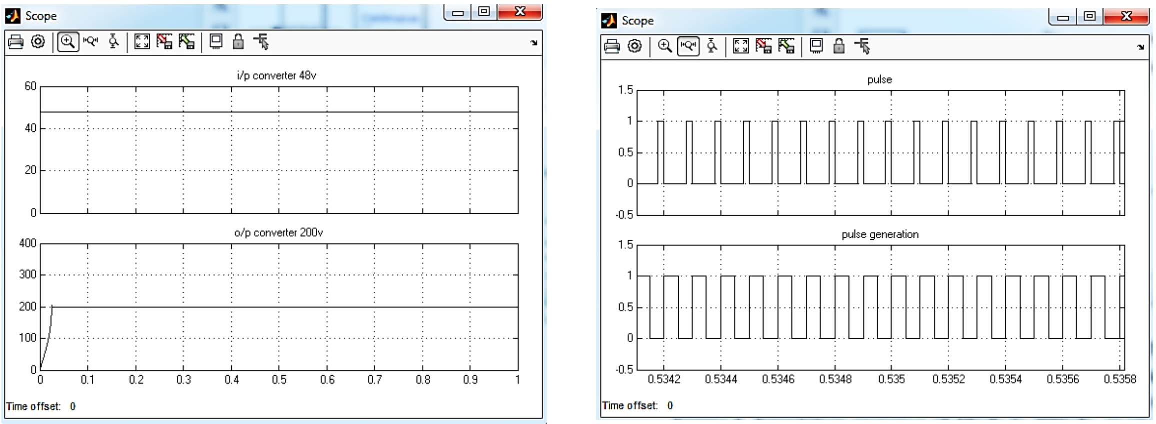


(b)

Figure 8. Simulation response of 48 vdc to 100 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=100

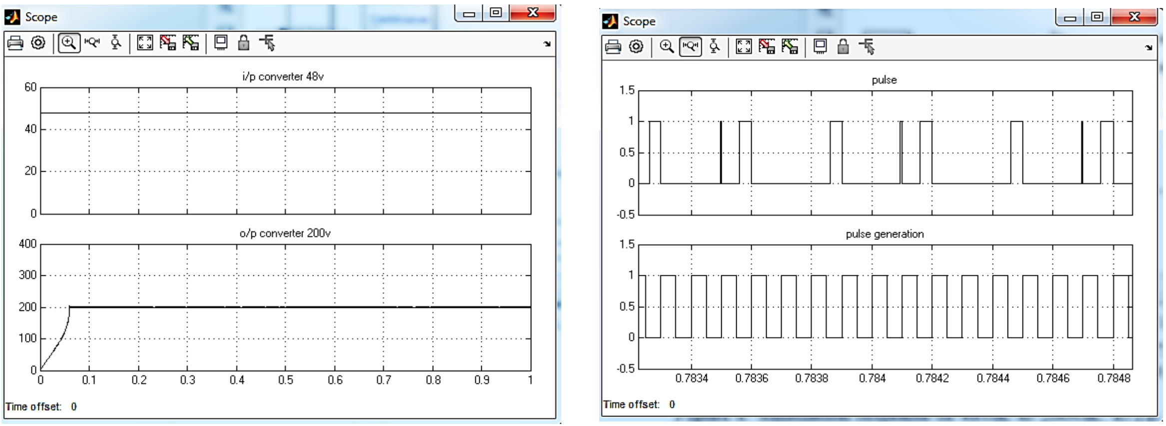
3.4. I/p (48vdc to 200vdc) o/p at Gain=50 and Gain=100

By using the simulation model in Figure 1(b) and Figure 2(b) to get the results for this part. The simulation response as shown in Figures 9 and 10, included i/p, o/p, pulse & pulse generation:



(a) (b)

Figure 9. Simulation response of 48 vdc to 200 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=50



(a) (b)

Figure 10. Simulation response of 48 vdc to 200 vdc; (a) i/p, o/p, (b) Pulse & pulse generation at gain=100

4. CONCLUSION AND FUTURE WORKS

It is proposed to implement a power electronic devise (DC-DC converter) circuit within the specifications mentioned in the simulation model above. Simulation of this proposed model for voltage regulation was conducted with the aim of validating system, simulation results show that the proposed system can be used effectively in many Applications that fit the specifications of the proposed system.

It has become necessary to use the electronic converter to overcome these difficulties by controlling this important process using classic PID controllers. The process of controlling the operation of the electronic transformer begins to improve the work of the system, and this is achieved by adapting it according to the suitability of the appropriate control parameters with the position of the control system capable of adjusting the shape of its objective value of the feed. This indicates that the pattern of the surrounding areas and the system can be used to control with multiple points.

The work simulation results confirm the idea that the electronic converter has better control performance with the classic PIDC for convincing control properties. Simulation and simulation of the electronic transformer functionality was achieved by using the MATLAB software package (SIMULINK). The authors suggest using other optimization methods such as FLC with PIDC and particle swarm optimization with PIDC to learn how they affect control parameters and compare these methods with GA_PIDC to find out the best.

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