

**UYGULAMALI BİLİMLER TAM METİN KİTABI**

**2. ULUSLARARASI MARDİN ARTUKLU  
BİLİMSEL ARAŞTIRMALAR KONGRESİ  
23-25 AĞUSTOS 2019  
MARDİN**



**Editörler**

Öğr. Gör. Yasemin AĞAOĞLU  
Dr. Figen YILDIZ

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Dr. Hasan CANGİ Dr. Öğr. Üyesi Süleyman ADAK Prof. Dr. Ahmet Serdar YILMAZ	VOLTAGE AND CURRENT RIPPLE DETERMINATION FOR ÇUK DC/DC CONVERTER
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Ebubekir İNAN	Θ-FUZZY APPROXIMATELY ALGEBRAIC STRUCTURES
Dr. Mustafa UÇKUN	NEAR-RINGS ON NEARNESS APPROXIMATION SPACES
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## VOLTAGE AND CURRENT RIPPLE DETERMINATION FOR ĆUK DC/DC CONVERTER

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### ABSTRACT

The Ćuk converter is a DC-DC converter which is essentially a cascade connection of the conventional boost converter and the buck converter having a capacitor to couple the energy. Its advantages mainly include the use of fewer number of switches, smooth input as well as output current and magnetic component integrability, etc.. Input current and output current have small ripple. However, requirement of capacitor C1 with large ripple current capability is disadvantages. The high ripple has a negative effect on the Ćuk converter, such as overheating, noisy operation and break down. In this study, the current and voltage ripple of Ćuk converter were found with the help of the Matlab/Simulink program. Ćuk converter contains two inductor and two capacitor. Hence it is fourth order DC-DC converter. It provides output voltage both higher as well as lower than the input voltage. Ćuk converters are used frequently in communication systems and renewable energy sources.

**Keywords:** Current ripple, Ćuk DC-DC converter, Converter used in renewable energy sources, DC-DC converters, Voltage ripple.

### 1. INTRODUCTION

DC-DC power converters are employed in a variety of applications, including power supplies for personal computers, Office equipment, space craft power systems, laptop computers, and telecommunications equipment, as well as dc motor drives. The input to a DC-DC converter is an unregulated DC voltage  $V_g$ . The converter produces a regulated output voltage  $V$ , having a magnitude (and possibly polarity) that differs from input voltage.

Today, the necessity for different values and forms of electrical energy is constantly increasing with the rapid development of technology. Therefore, many types of converters have been developed. DC-DC converters convert input voltage values to output voltage at different levels and values. Power electronics inverters are frequently used in renewable energy sources in battery charging circuits, DC machines and similar industrial applications. DC-DC converters are the basic converters in switch mode power supplies (Fuad, et al; 2004, Keyueve Suk, 1995). Often DC-DC converters are classified as follows:

- a) Step-up (boost) converter
- b) Step-down (buck) converter
- c) Step-down/up (buck-boost) converter
- d) Ćuk converter

Ćuk converters are circuits that convert a DC voltage to a DC voltage of different amplitudes. Ćuk converters are mainly consisted of two inductors, two capacitors, one diode and one switching element. A Ćuk converter can be obtained by sequential coupling of the amplifier converter and the reducer converter (Ozdemir and Erdem; 2017, Vatché, 1996). Figure 1 shows a schematic diagram of the Ćuk converter.

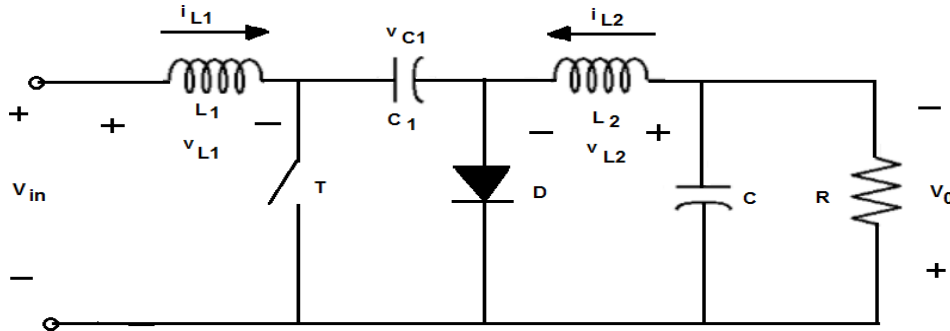


Figure 1. Principle of Ćuk converter

Ćuk converter has inverted voltage polarity at the output, however, it operates on the principle of capacitive energy transfer and uses inductors on both sides of the switch to reduce current ripple. The paper attempts to analysis current and voltage ripple of cuk DC-DC converter. In Ćuk inverters, the polarity of the output voltage is the opposite of the input voltage as it is in the boost / buck converters.

In Ćuk converters, there are two operating states, which are the only switching elements that are single switching elements. The first is a switching element in transmission mode and the second is in cutting mode. (Acikgoz et al., 2016, Simonetti et al., 1997, Chincholkar and Chan; 2015).

## 2. RESEARCH

In this context, we have examined the Ćuk converters that can be operated both as boost and buck in DC/DC converters. Ćuk converters can be operated in two different states: When the switch is in cut mode, the inductances' currents  $i_{L1}$  and  $i_{L2}$  flow through the diode. The capacity  $C1$  is loaded by the energy passed over the  $L1$  inductance. The voltage of  $i_{L1}$  decreases because the voltage of  $v_{C1}$  is higher than the  $v_S$  voltage. In this time of period, the energy accumulated at  $L2$  feeds the output. Figure 2 shows a diagram of the Ćuk DC/DC converter.

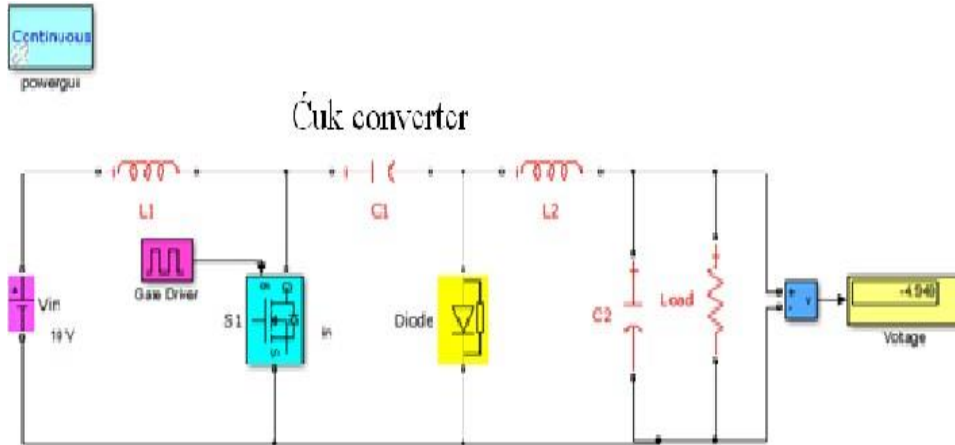


Figure 2. Simulink equivalent of Ćuk converter

The Matlab/Simulink software package can be advantageously used to simulate the Ćuk converters. This study aims to analyze the current and voltage ripple in Ćuk converter. Analysis of the Ćuk converter can be examined in two parts. The state in which the switching element is in transmission, and the second in which the switching element is in the cutting. Figure 3 shows the change of current and voltage to the transmission and cutting states of the main element of the Ćuk converter.

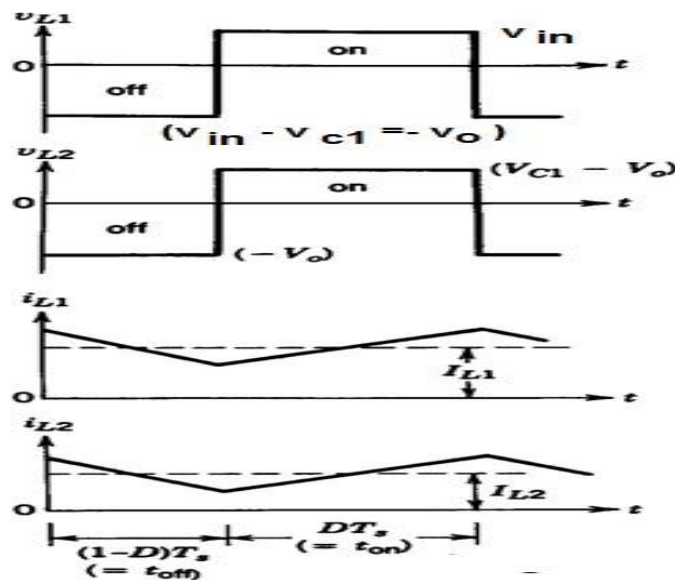


Figure 3. Current and voltage waveforms of Ćuk converter

The first part which needs to be examined In Figure 2, the current flowing through the  $L_1$  inductance when the switching element is in the transmission state (Closed loop on the left side of switch  $S$ ). When we look at the right side of the circuit, the voltage induced by the capacitor

$C_1$  is polarized in the opposite direction and so the current does not flow through the diode in the circuit. The  $V_{C1}$  diode is reversed when the switch is in transmission. Inductance currents  $i_{L1}$  and  $i_{L2}$  flow through the reverse switch as shown in the figure. Since  $V_{C1} > V_0$ , the  $C_1$  capacity energy is discharged through the switch by transferring it to the output and  $L_2$ . For this reason,  $i_{L2}$  increases. Current and voltage change can be observed in the Ćuk converter when the T is on. See Figure 4.

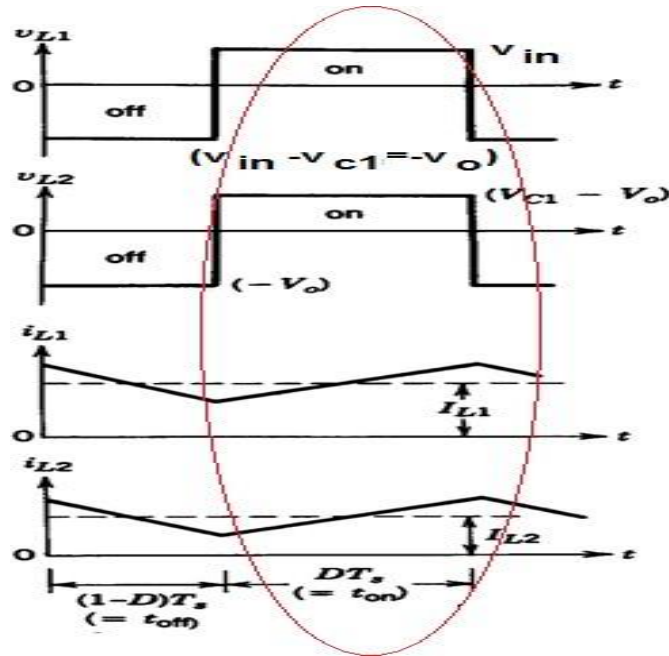


Figure 4. Ćuk converter's current and voltages

The second part which needs to be examined basically on the energy of the capacitor  $C_1$ , where is discharged on the capacitor  $C_2$ , inductor  $L_2$  and also on the load respectively. (Closed loops on the right side of switch  $S$ ). In this case, the energized  $L_1$ ,  $L_2$  inductors and also capacitor  $C_2$  have been discharged when the circuit is taken into consideration as continuously state also the switch is in the cutting mode as well. In the same way, the capacitor  $C_1$  is also energized when the switch is cut. When switch T is off, Current and voltage changes can be observed in Ćuk converter when the switch T is off. See Figure 5.

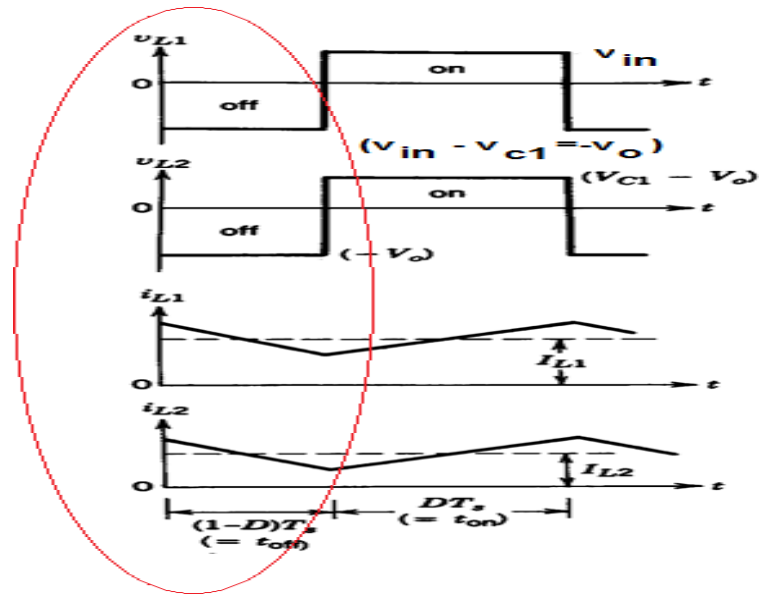


Figure 5. Ćuk converter current and voltages (cut-off)

In the second case, the current is flowing through the diode opposite polarity compare to the first case. The capacitor  $C_1$  is energized by the  $V_{in} + V_{L1}$  voltage due to the closed loop in the left of the diode. The  $L_1$  inductor consumes the energy that it charged in the first case. Here the load is fed by the energy that accumulated in  $L_2$  through the  $D$  diode.

The load is also fed by  $C_2$  as well. In the open switch circuit topology, the capacitor  $C_2$  supplies energy transfer from source to load. Similar to the boost and buck converter, the Ćuk converter also produces a reverse polarity output voltage relative to the common end of the input voltage. Here,  $C_1$  is the main component for accumulating the energy and also carrying it from input to output. In continuous operation state, the average of inductance voltages  $V_{L1}$  and  $V_{L2}$  are zero.

$$V_{C1} = V_{in} + V_0 \quad (1)$$

$V_{C1}$  voltage is greater than  $V_{in}$  and  $V_0$  voltages. The value of the  $L_1$  inductance voltage,

$$V_{L1} = V_{in} - V_{C1} \quad (2)$$

The value of the  $L_2$  inductance voltage,

$$V_2 = -V_0 \quad (3)$$

Switch Off state: The inductor currents flow through the diode. Capacitor  $C_1$  is charged through the diode by energy from both the input and  $L_1$ . The current  $I_{L1}$  decreases, because  $V_{C1}$  is larger than  $V_{in}$ , Energy stored in  $L_2$  feeds output and there for  $I_{L2}$  decreases, Therefore,  $I_{L2}$  also decreases. It is assumed that inductance currents  $I_{L1}$  to  $I_{L2}$  are continuous. Continuous voltage and current indications can be obtained in two different ways. Assuming the capacity voltage  $V_{C1}$  is constant, if we equate the integral of the voltages on  $L_1$  and  $L_2$  in a period of zero, equating the integral voltages of  $L_1, L_2$  over one period:

$$L_1: V_{in}DT + (V_{in} - V_{c1})(1 - D)T = 0 \quad (4)$$

Voltage of  $C_1$  capacitor ,

$$V_{c1} = \frac{V_{in}}{(1-D)} \quad (5)$$

obtained.

$$L_2: (V_{c1} - V_0)DT + (-V_0)(1 - D)T = 0 \quad (6)$$

Here,

$$V_{c1} = \frac{V_0}{D} \quad (7)$$

found. From eqs. (6) and (7),

$$\frac{V_0}{V_{in}} = \frac{D}{(1-D)} \quad (8)$$

obtained. The biggest advantage of the Ćuk converter is that the input and output currents have a very low ripples. The output voltage is controlled by controlling the switch-duty cycle. The ratio of output voltage to input voltage is given by:

$$\frac{I_{in}}{I_0} = \frac{D}{(1-D)} = \frac{V_0}{V_{in}} \quad (9)$$

Where,  $V_0$  and  $V_{in}$  are the output and input voltages, respectively. The term  $I_0$  and  $I_{in}$  is the output and input currents, respectively. The term  $D$  is the duty ratio and defined as the ratio of the on time of the switch to the total switching period. This shows the output voltage to be higher or lower than the input voltage, based on the duty-ratio  $D$ .

## 2.1 . FINDINGS

Single switch converters such as buck, boost, sepic and Ćuk are used in renewable energy sources, active power factor correction circuits and uninterruptible power supplies where their input and output voltage is highly variable. Figure 7 shows the change in output voltage of the Ćuk converter.

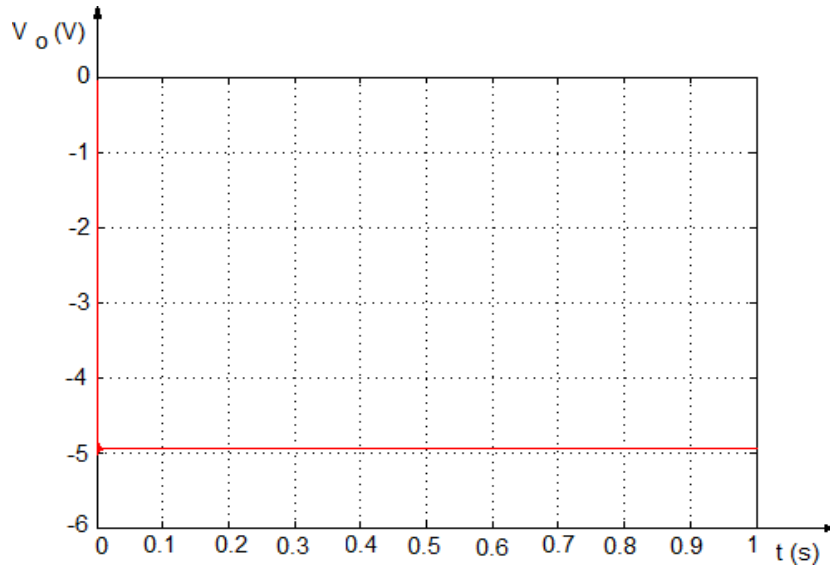


Figure 7. Output voltage and current of Ćuk converter

The change in inductance currents of  $I_{L1}$  and  $I_{L2}$  used in the Ćuk converter is given in Figure 8.

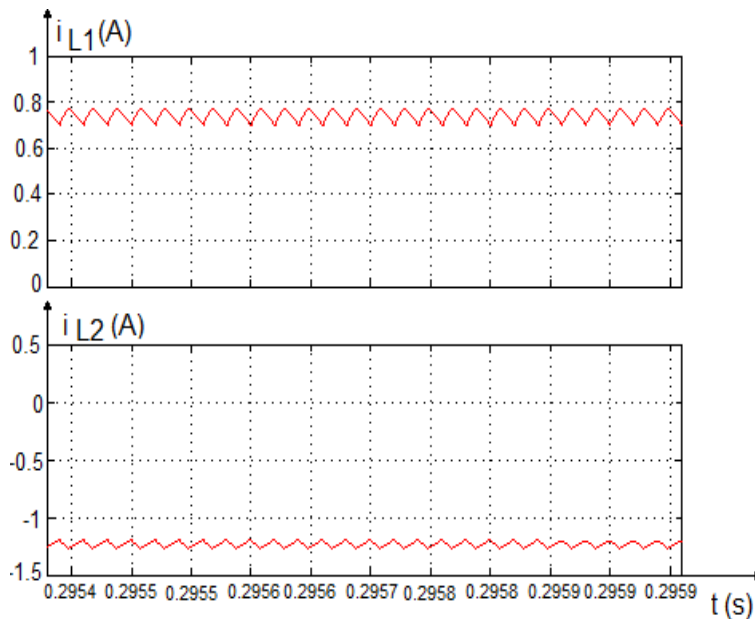


Figure 8. Change of  $I_{L1}$  and  $I_{L2}$  currents in the Ćuk converter

A different control mechanism is needed in order to control the same system. The system we are examining is a Ćuk converter. The output voltage of this system has been handled in this study. Each system has been inspected in the automatic control systems. The role of the controlling organ in a closed loop within the control system is referenced the output voltage of the feedback at the measuring point then the system is checked by comparing with the given input size and repeating the difference of the error value to the output by producing control signal in accordance with the effect of the own control system. The voltage of the capacitor C1 is shown in Figure 9.

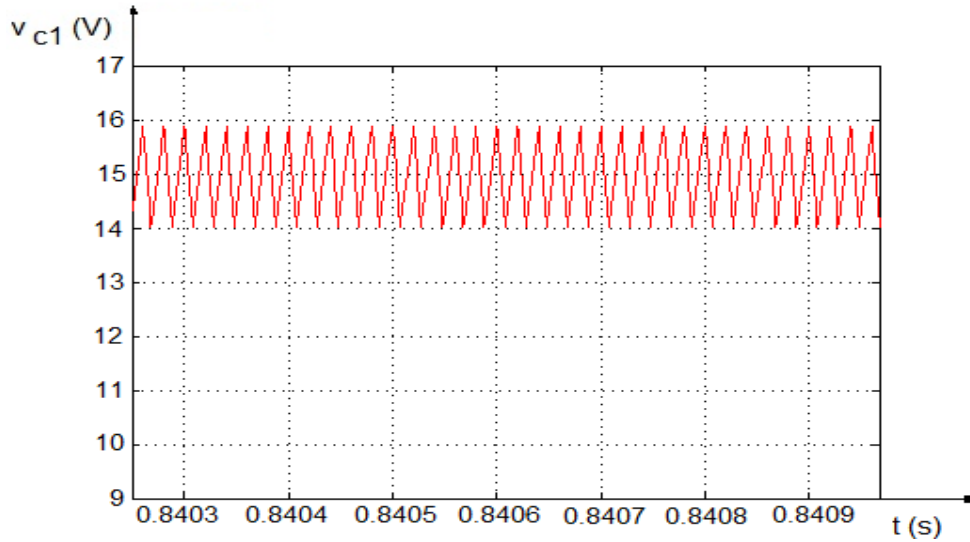


Figure 9. Change of  $C_1$  capacitor output voltage

Some basic features of the Ćuk converter:

- The output voltage can be higher or lower than the input voltage
- The output voltage is negative
- Capacitor  $C_1$  stores and transfers energy
- in steady state average inductor voltages  $V_{L1}$ ,  $V_{L2}$  are zero
- $V_{C1}$  is larger than  $V_{in}$  and  $V_o$

### 3. RESULTS

The Ćuk converter, similar to the buck boost converter provides a negative polarity regulated output voltage with respect to a common terminal. However here the capacitor acts as a primary means of energy storage and transfer between input and output, unlike the inductor in the buck boost. Also the capacitor used in Ćuk regulator is very large. Thus both the input current and the current feeding the output stage are largely ripple free. This is unlike the buck boost regulator where both these currents are highly discontinuous. It is possible to simultaneously eliminate the ripples in both the inductors of the Ćuk regulator completely, leading to lower external filtering. However a major disadvantage of the Ćuk converter is the requirement of a large capacitor with large current carrying capacity.

One of the most important features in the Ćuk is that the ratio of ripples is too low for inductance currents of the  $I_{L1}$  to  $I_{L2}$ . The size of elements that store the energy in the Ćuk converter is significantly higher than buck converter that can reduce the input voltage and also boost converter which can increase the input voltage. In Ćuk converters, the power transferred directly to the load is zero and total power is processed by the switching elements and transferred to the load. This situation leads the voltage of elements to increase as well as the sizes of the energy storage elements. In continuous operation, the average inductance voltages  $V_{L1}$  and  $V_{L2}$  are zero. The voltage at the capacitor terminals  $C_1$  is equal to the sum of the input and output voltages of the inverter ( $V_{C1} = V_{in} + V_o$ ).

## REFERENCES

- Fuad, Y., deKoning W. L., van der Woude, J. W. (2004). On the Stability of Pulsewidth-Modulated Cuk Converter, *IEEE Transactions on Circuits and Systems II: Express Briefs*, Vol. 51, No. 8.
- Keyue M. S., Šuk, S. (1995). Dynamics of One-Cycle Controlled cuk Converters, *IEEE Transactions on Power Electronics*, Vol. 10, No. 6.
- Özdemir, A., Erdem, Z. (2017). Double-loop PI controller design of the DC-DC boost converter with a proposed approach for calculation of the controller parameters - Journal of Systems and Control Engineering - Vol. - pp. - ISSN: - DOI: 10.1177/0959651817740006.
- Vatché, V. (1996). The Effect of the Magnetizing Inductance on the Small Signal Dynamics of the Isolated cuk Converter, *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 2, No. 3.
- Açıkgöz, H., Keçecioglu, Ö. F., Gani, A., Yıldız, C., Şekkeli, M. (2016). Improved control configuration of PWM rectifiers based on neuro fuzzy controller, *Springer Plus*.
- Simonetti, D. S. L., J. Sebastian, J., J. Uceda, J. (1997). The discontinuous conduction mode Sepic and Cuk power factor preregulators: Analysis and design, *IEEE Trans. Ind. Electron.*, vol. 44, no. 5, pp. 630–637.