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# Comparison of Sensorless Current Controlled DC – DC Converter Using Intelligent Control Techniques

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## ABSTRACT

A sensor less voltage control mode (SVM) control is an observer method that provides the operating benefits of voltage mode control without voltage sensing. SVM has significant advantages over both conventional peak and average current mode control techniques in noise susceptibility and dynamic range. The elimination of current steady –state error and achieve high accuracy current estimation purpose using incentivization. It achieves the highest observation accuracy by compensating for all the known parasitic parameter. To control the voltage neural network is implemented. Considerably we have both positive and negative range deviations in power productions. To counter this in my project there would be trials of two converters used (Boost, SEPIC). It reduces the control complexity to a single loop. Also, simulation is done using MATLAB/SIMULINK model and results are presented to verify the operation.

**Keywords:** BOOST Converter, SEPIC Converter

## I. INTRODUCTION

Regardless of the type of feedback control, almost all DC-DC converters and linear regulators sense the inductor current for over-current (over-load) protection. Additionally, the sensed current is used in current-mode control DC-DC converters for loop control. Since instantaneous changes in the input voltage are immediately reflected in the inductor current, current-mode control provides excellent line transient response. Another application for current sensing in DC-DC converters is also reported where the sensed current is used to determine when to switch between continuous-conduction mode (CCM) and discontinuous-conduction mode (DCM), which results in an overall increase of power efficiency in the DC-DC converters.

## II. BOOST CONVERTER

A boost converter (step-up converter) is a dc-dc power that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element, a capacitor, inductor or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).

The boost converter is the tendency of an inductor to resist changes in current by creating and destroying a magnetic field. In a boost converter, the output voltage is always higher than the input voltage.

(a) When the switch is closed, current flows through the inductor in clockwise direction and the inductor stores some energy by generating a magnetic field. Polarity of the left side of the inductor is positive.

(b) When the switch is opened, current will be reduced as the impedance is higher. The magnetic field previously created will be destroyed to maintain the current towards the load. Thus the polarity will be reversed (means left side of inductor will be negative now). As a result, two sources will be in series causing a higher voltage to charge the capacitor through the diode D.

The basic principle of a Boost converter consists of:

- In the On-state, the switch is closed, resulting in an increase in the inductor current;
- In the Off-state, the switch is open and the only path offered to inductor current is through the flyback diode D, the capacitor C and the load R. This result in transferring the energy accumulated during the On-state into the capacitor.

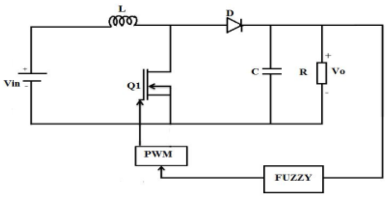


**Figure 1.** Boost DC-DC converter

## III. SINGLE ENDED PRIMARY INDUCTANCE CONVERTER:(SEPIC)

Circuits run best with a steady and specific input. Controlling the input to specific subcircuits is crucial for fulfilling design requirements. AC-AC conversion can be easily done with a transformer; however dc-dc conversion is not as simple. Diodes and voltage bridges are useful for reducing voltage by a set amount, but can be inefficient. Voltage regulators can be used to provide a reference voltage. Additionally, battery voltage decreases as batteries discharge which can cause many problems if there is no voltage control. The most efficient method of regulating voltage through a circuit is with a dc-dc converter.

There are 5 main types of dc-dc converters. Buck converters can only reduce voltage, boost converters can only increase voltage, and buckboost, Cúk, and SEPIC converters can increase or decrease the voltage. Some applications of converters only need to buck or boost the voltage and can simply use the corresponding converters. However, sometimes the desired output voltage will be in the range of input voltage. When this is the case, it is usually best to use a converter that can decrease or increase the voltage. Buck-boost converters can be cheaper because they only require a single inductor and a capacitor. However, these converters suffer from a high amount of input current ripple. This ripple can create harmonics; in many applications these harmonics necessitate using a large capacitor or an LC filter. This often makes the buck-boost expensive or inefficient .

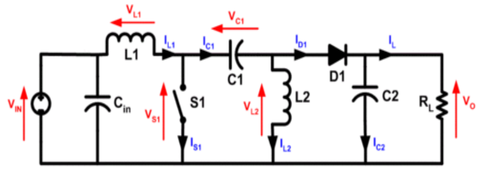


**Figure 2.** Schematic diagram of SEPIC converter

The voltage drop and switching time of diode D1 is critical to a SEPIC's reliability and efficiency. The diode's switching time needs to be extremely fast in order to not generate high voltage spikes across the inductors, which could cause damage to components. Fast conventional diodes or Schottky diodes may be used.

The resistances in the inductors and the capacitors can also have large effects on the converter efficiency and ripple. Inductors with lower series resistance allow less energy to be dissipated as heat, resulting in greater efficiency (a larger portion of the input power being transferred to the load). Capacitors with low equivalent series resistance (ESR) should also be used for C1 and C2 to minimize ripple and prevent heat build-up, especially in C1 where the current is changing direction frequently.

- Like the buck–boost converter, the SEPIC has a pulsating output current. The similar Ćuk converter does not have this disadvantage, but it can only have negative output polarity, unless the isolated Ćuk converter is used.
- Since the SEPIC converter transfers all its energy via the series capacitor, a capacitor with high capacitance and current handling capability is required.
- The fourth-order nature of the converter also makes the SEPIC converter difficult to control, making it only suitable for very slow varying applications.

However, the additional components are far outweighed by the remarkable advantages gained and expecting the popularity of this technique with respect to other exiting topologies. The performance of the converter is verified by means of simulation results. This paper has presented a modified SEPIC converter with a Continuous output current.

## IV. CIRCUIT FOR SEPIC CONVERTER

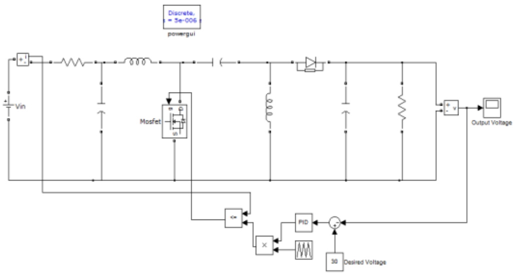

**Figure 3.**Simulation diagram for SEPIC converter

### OUTPUT FOR SEPIC CONVERTER

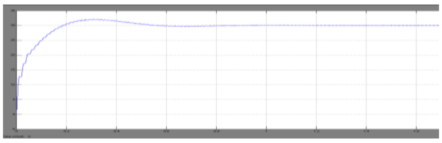

**Figure 3.** Output for SEPIC converter

## V. CIRCUIT FOR BOOST CONVERTER

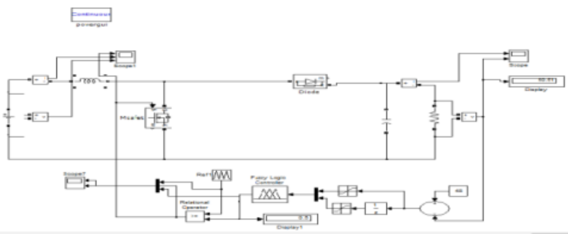

**Figure 4.**Simulation diagram for Boost converter

### Output for Boost Converter

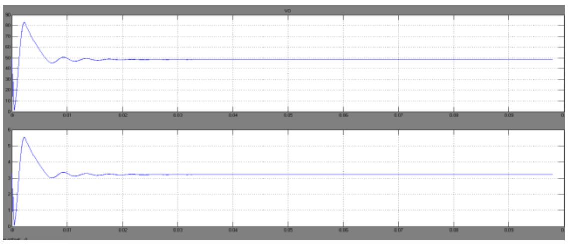

**Figure 5.**Output for Boost converter

## VI. COMPONENTS SPECIFICATION OF SIMULATION MODEL

| SL.NO | PARAMETER | BOOST CONVERTER RATINGS | SEPIC CONVERTER RATINGS |
|---|---|---|---|
| 1. | Amplitude | 12V | 12V |
| 2. | Inductance 1 | 0.00008625 | 1e-3 |
| 3. | Inductance 2 | - | 1e-3 |
| 4. | Capacitor 1 | 1.63e-7 | 4700e-6 |
| 5. | Capacitor 2 | - | 4700e-6 |
| 6. | Resistance 1 | 46 | 1ohm |
| 7. | Resistance 2 | - | 50 ohm |
| 8. | Designed Voltage | - | 30 |
| 9. | Mosfet | Constant | Constant |
| 10. | Diode | Constant | Constant |
| 11. | Pid Controller | - | .1034 |
| 12. | Time Values | [0 0.00001 0.00002] | [01/40e3 1/20e3] |
| 13. | Output Values | [0 1 0] | [0 1 0] |
| 14. | Relational Operator | >= | <= |
| 15. | Complexity | Medium | High |
| 16. | Cost | Medium | High |
| 17. | Efficiency | Medium | Medium to High |
| 18. | Output Current | 3Ohm | Medium to High |
| 19. | Output Voltage | 52V | 48V |

## VII. RESULT AND DISCUSSION

In this paper represents the input voltage is 12V and get the boosted output voltage is 48V by using boost converter and sepic converter. In the existing system PI controller is used but that controller cannot effectively eliminate the steady state output voltage error. So, when the gate pulse is given to the MOSFET, pulse width modulation (PWM) is generated which effectively eliminates the output voltage steady state error.

The mentioned one is the accurate, whereas the Hall current sensors cost is relatively high, and it reduces system reliability. The sensorless current control should be estimated by using current observer. The input voltage of the system is boosted to get an increased output voltage by using boost converter.

## VIII. CONCLUSION

A sensorless predictive peak current control with computing technique has been presented in this paper. Simulation shows that the proposed system is very robust. In addition, its computational complexity is low and easy to implement. With the proposed system, the system ultimately achieves no voltage steady-state error with good transient performance despite parasitic parameters variation. This controller can effectively eliminate the voltage steady state error and achieve high accuracy current estimation without using current sensor.

## IX.REFERENCES

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