Dual Input Non Isolated Switched Inductor SEPIC Converter with High Voltage Gain

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Abstract: The dual input non-isolated switched inductor SEPIC converter is proposed here. This converter combines dual input SEPIC converter and switched inductor SEPIC converter. The non-conventional source of electricity is more distinguished than the conventional sources as they do no longer produce any by products that is dangerous. The output from the renewable sources (for eg, sun energy) is very low and should be stepped up for numerous applications. Dual Input Non Isolated Switched Inductor SEPIC Converters have two input sources and can be used to step up the voltage. This converter presents extensive range and preference of input sources and is suitable for boost applications. The converter has no transformers and cascade connections so it is simple and has voltage gain more than the converters used for combination. The proposed converter have been designed for 24V and 12V input supply, 25kHz and 40% duty cycle. The proposed Dual Input switched inductor SEPIC (SI-SEPIC) converter is simulated in MATLAB/SIMULINK.

1. Introduction

Nowadays, high step up converters has an essential role in lots of applications like photovoltaic system, traction system, uninterrupted power supplies, fuel cell system. Because of the PV panel parasitic capacitance the output received from the PV module is insufficient to use to inverter unit. So it’s miles important to have a high step up converters. As the transformer is absent in non-isolated converter, it has better performance and lower cost than isolated converters. A boost converter is generally incorporated with the PV panels, but excessive voltage gain and efficiency can no longer be obtained simultaneously using a traditional boost converter. The variety of factors inside the multi-level boost converter is high however the converter suffers from high switching losses because of reverse recovery difficulty of the output diode.

The renewable sources are sufficiently to be had in nature with free from cost and have a terrific capability of power generation. The non-conventional electricity source is superior to conventional source based energy in account of cost as well as harmful by way of by products which pollute the environment. Conventional boost converter turns into risky while operated at high duty cycles so it isn't capable of produce excessive gain. The gain can be stepped forward by means of integrating the converters .The drawback is that the device becomes complex and losses will be greater. Via using transformers or coupled inductors, the gain of the converter can be improved which reduces the efficiency of the converter .therefore the Proposed converter eliminates the drawbacks of the isolated converters producing high gain.

Dual Input Switched inductor SEPIC (DISISEPIC) converter is obtained from conventional SEPIC by adding switched inductor instead of supply side inductor with two input sources. Switched inductor is the combination of two inductors and three diodes in which inductors are charged in parallel and discharges in series. The proposed DISISEPIC converter have large voltage gain compared with the traditional SEPIC converter.

2. DISISEPIC Converter

2.1 Power Circuit

Dual input switched inductor SEPIC (DISISEPIC) converter is obtained from combining dual input SEPIC converter and switched inductor SEPIC converter. Here switched inductor is present instead of supply side inductors in the conventional SEPIC converter. The power circuit diagram of dual input switched inductor SEPIC converter is shown in Fig1.

![Fig1.Dual Input SI-SEPIC Converter](image-url)
and \( L_o \), single power switch \( S \), seven diodes \( D, D_1, D_2, D_3, D_4, D_5, D_6 \) and two capacitors \( C, C_o \). Capacitor \( C_o \) is used to deliver the power to load side inductor. The converter has two switched inductor network.

### 2.3. Analysis and operation of DISISEPIC Converter

The proposed Dual Input Switched Inductor SEPIC Converter circuit is analyzed in continuous conduction mode. In continuous conduction mode (CCM), the operation of DISISEPIC converter circuit can be explained by two modes, one while switch \( S \) is turned ON and another when switch \( S \) is turned OFF.

#### 2.3.1. Mode 1

The switch \( S \) is turned ON at mode 1. The equivalent circuit diagram for mode 1 operation is shown in Fig.2. At this mode the inductors in the two switched inductor network is charged by the input sources. Inductor \( L_1 \) and \( L_2 \) are charged in parallel by the dc source \( V_1 \) through diode \( D_1 \) and \( D_2 \). Similarily inductor \( L_3 \) and \( L_4 \) are charged in parallel via dc source \( V_2 \) through diode \( D_4 \) and \( D_5 \). Capacitor \( C \) provides energy to the inductor \( L_o \) through switch \( S \). Capacitor \( C_o \) is discharges through load. Since inductors \( L_1, L_2, L_3 \) and \( L_4 \) are equal, same amount current is flowing through inductors \( L_1, L_2, L_3 \) and \( L_4 \).

#### 2.3.2. Mode 2

In this mode of operation switch \( S \) is turned OFF. The equivalent circuit diagram for mode 2 operation is shown in Fig.3. The inductors in the two set of switched inductor network are discharged in this mode. Inductor \( L_1 \) and \( L_2 \) are discharges in series and provide energy to capacitor \( C \). Likewise Inductor \( L_3 \) and \( L_4 \) are discharges in series and provide energy to capacitor \( C \). Inductor \( L_o \) is discharges through load and capacitor \( C_o \). In this mode diode \( D, D_1 \) and \( D_6 \) are forward biased.

### 3. Simulation Results

The Dual Input SI-SEPIC Converter is designed for 24V and 12V input supply, 25 kHz and 40% duty cycle. The proposed SI-SEPIC converter is simulated in MATLAB/SIMULINK. The simulation circuit of proposed converter is shown in fig.4.
The input voltage waveforms are shown in fig. 5 and fig. 6. Here source voltages are 24V and 12V, the obtained output voltage is 120V and the waveform is shown in fig. 7.

4. Acknowledgements

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5. References


