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A Novel Single Source Multiple Output Converter Integrating Buck-Boost and Fly Back Topology for SMPS Applications

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Abstract

This paper presents a novel single DC input source and multiple DC output suitable for switched mode power supply (SMPS) applications integrating interleaved boost and sepic converter with fly back topology. The proposed converter can be remodeled for any required output voltage power supply without changing hardware structure because wide range of output voltage can be obtained using sepic and boost converters by changing duty cycle command by implementing a simple voltage input pi controller. Conventional fly back topology is added to interleaved circuit to produce desired dc output voltage this voltage can be controlled by choosing turns ratio of fly back transformer. The proposed multi output DC converter is simulated in MATLAB/Simulink environment and results are presented for verifying merits of the converter.

Keywords*: SMPS, Sepic, Fly back, Multiple DC output, PI controller*

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1. Introduction

Multiple outputs DC-DC converters are employed in various applications such as SMPS, test benches. Conventional SMPS involve converting input ac to dc and use switching transformers and power supply regulators to achieve desired output voltage. Introduction of power electronic converters to SMPS does not requires such regulators rather precise control of output voltage can be obtained by performing closed loop control of such converters. Paper [1] presented a high efficient multi output DC converter combining the advantages of both cuk and boost converter. Literature [2-3] shows a single inductor based single and multi input but multiple output DC-DC converter with certain degree of efficiency. Literature [4] proposed a single inductor multi output power supply in both continuous and discontinuous conduction mode of operation. Reference [5] proposed a multiple output DC-DC buck converter with modified control topology like single discharge control.

2. Proposed Converter

Figure 1 shows the overall block diagram of proposed single input multiple outputs DC-DC converter for SMPS applications. DC input is fed to integrated boost and sepic converter both the converters share the input source and they operate in interleaved mode of operation. A fly back unit is added at source inductance which acts as a voltage multiplier unit and ac output from fly back unit is rectified to obtain dc voltage from fly back converter [6] [7]. Output DC voltage from fly back can be controlled using transformer turns ratio. The proposed converter can be redesigned for any required output voltage power supply without changing hardware structure because wide range of output voltage can be obtained using sepic and boost converters by changing duty cycle command by implementing a simple voltage input pi controller.

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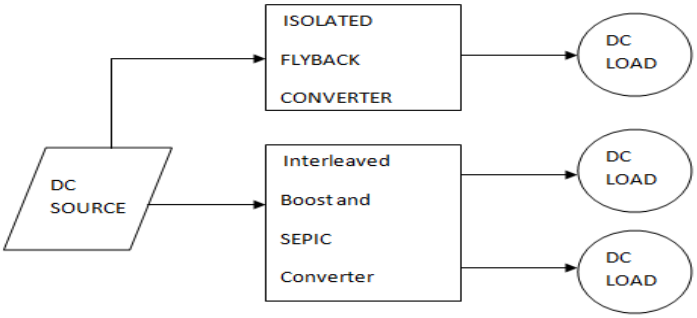

Figure 1. Block diagram of proposed multi output converter

3. Simulation Results and Discussion

Figure 2 shows circuit diagram of proposed multiple output dc-dc converter. This is simulated in MATLAB/Simulink environment and results are presented for verifying the merits of proposed multiple output DC-DC converter. Table 1 shows simulation parameters of passive elements used in the circuit. Figure 3-6. Shows response of proposed converter for 20v input dc source and output of three isolated DC supplies from boost converter, fly back converter and sepic converter.

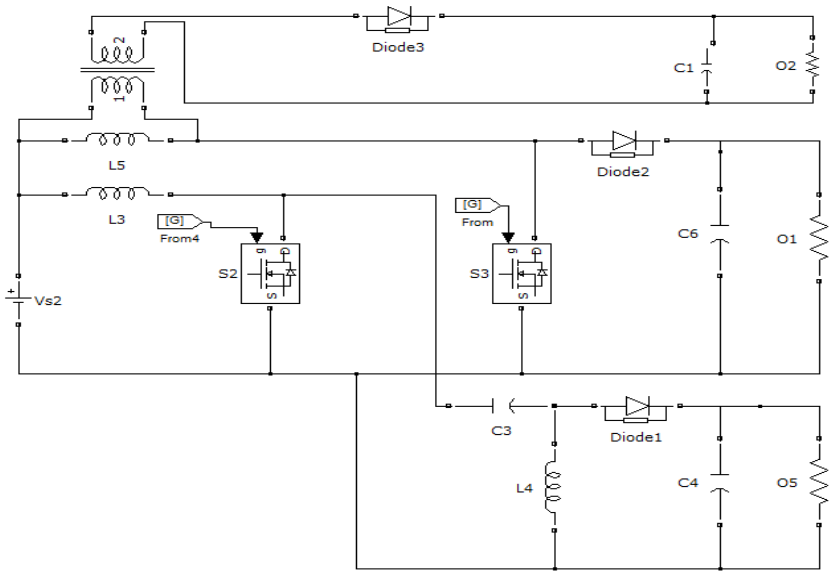

Figure 2. Circuit Diagram of Proposed Converter

Table 1. Simulation parameters

DC Input Voltage	20v
Output Voltage	32v X 3
Inductor Ls,L1	300uH,200uH
Capacitor C1,C4,C6	100uF,1000uF,1000uF
Transformer ratio n	1:2
Load resistor	100 ohms

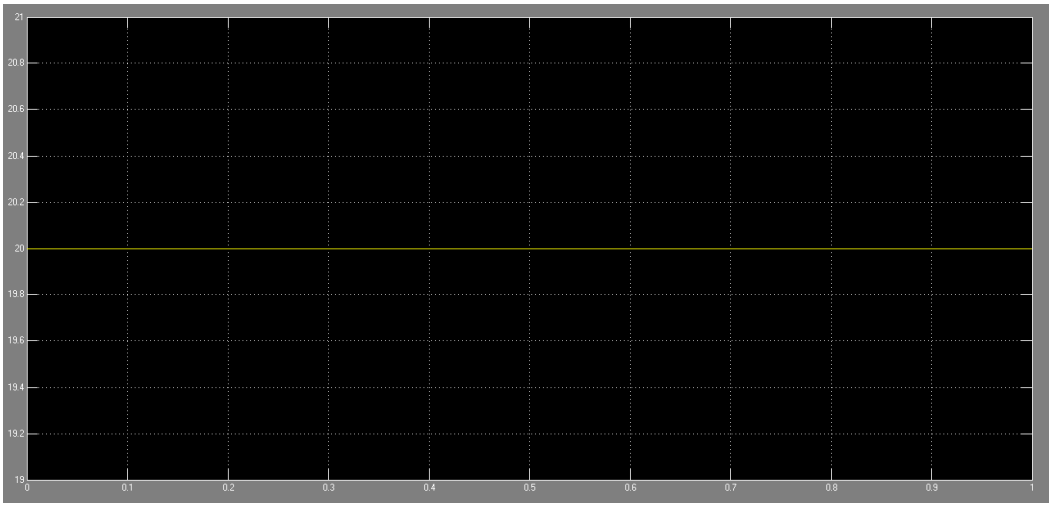

Figure 3. Single input DC source voltage waveform

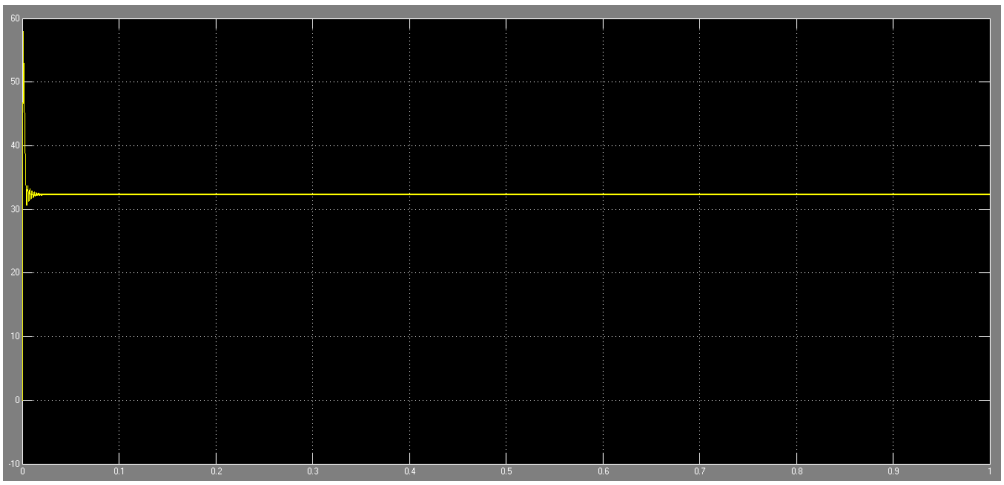

Figure 4. Boost converter output voltage waveform

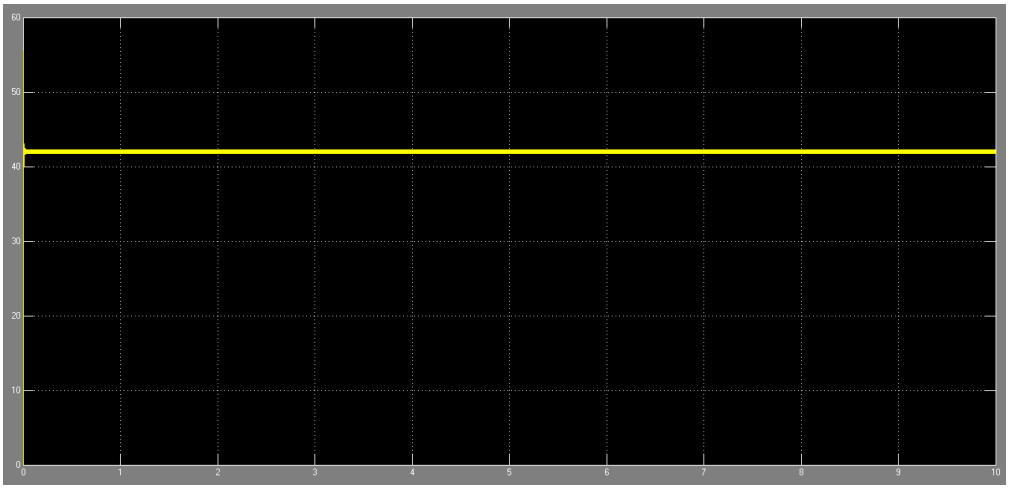

Figure 5. DC output from fly back circuit

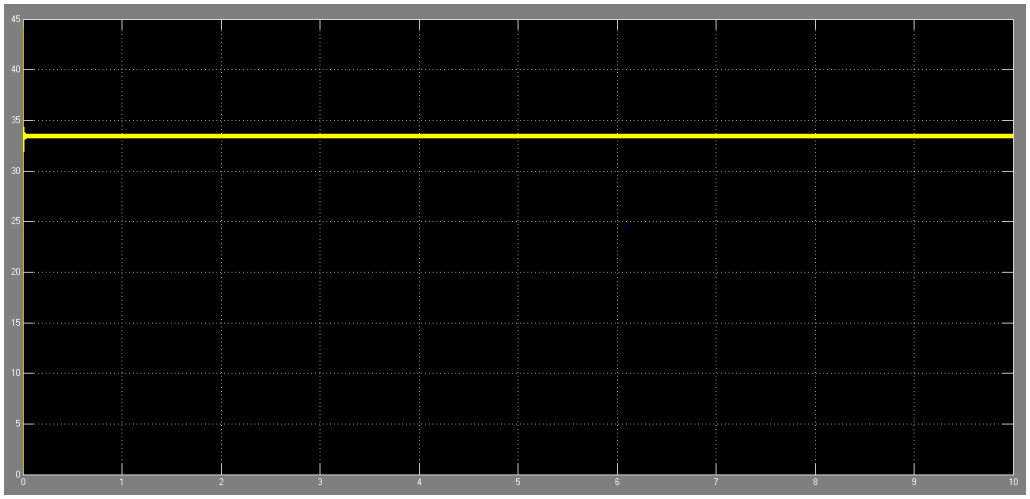

Figure 6. DC output from sepic

4. Conclusion

Proposed single input multi output DC-DC converter is implemented in Simulink and results are presented in previous section. Results verify the robustness of proposed scheme and efficiency of proposed converter is compared to conventional schemes.

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