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Study On Integrated Single Input Dual Output Dc-Dc Converter Using Renewable Energy Application

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ABSTRACT: There are many applications that demand single input dual output dc-dc converter, employing two separate single input single output converters. So the number of components is increased and subsequently the manufacturing cost is also increased. In order to reduce costs, this paper proposes study of an integrated single input dual output dc-dc converter which reduces the number of components.Integrated single input dual output converter is a DC-DC power converter which performs both buck and boost operations at the same time with a single power supply. Integrated single input dual output converter (IDOC) is derived from the conventional buck-boost converter using couple of power switches. The integrated single input dual output dc-dc converter can be easily developed from conventional single input single output buck-boost converter by replacing a diode and input/output ports.

KEYWORDS: Integrated single input dual output converter, zero voltage switching.

I. INTRODUCTION

The DC-DC Power converter has employed in the industrial applications and also in renewable energy applications. It demands the high quality DC voltage regulation, so the use of this converter is more relevant. For considering the solar PV application, the single input for a solar PV array can be utilized for the multiple loads of different voltage levels. As an additional advantage of this converter, we can get with the output high efficiency. The different voltage levels are regulated by the DC voltage for multiple loads that can be obtained by varying the duty cycle of the individual IGBT's (or MOSFET). The isolation of the load and supply is done in the integrated converter. The study of MATLAB simulation output results that the variation of the duty cycle of the converter leads to the variation in the output of the multiple loads. .

In general, an N- output system requires 2N number of switches for a high efficiency synchronous implementation.For efficient operation of systems using multiple outputs, there should be proper coordination of control between each of the converters for power flow management. This is generally accomplished by cooperative coordination between the feedback control systems of the converters. Shows the system where a single integrated architecture is used to interface the different outputs. In order to overcome this disadvantage, the series connected switch is used.

The SIDO DC-DC converter block is driven by the driver circuit which is used to provide the various duty cycles to the respective switches. The variation in the duty cycle results variation in the output of the SIDO DC-DC converter. Thus, the required output can be obtained by the varying the duty cycle.

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BLOCK DIAGRAM OF ISIDO CONERTER

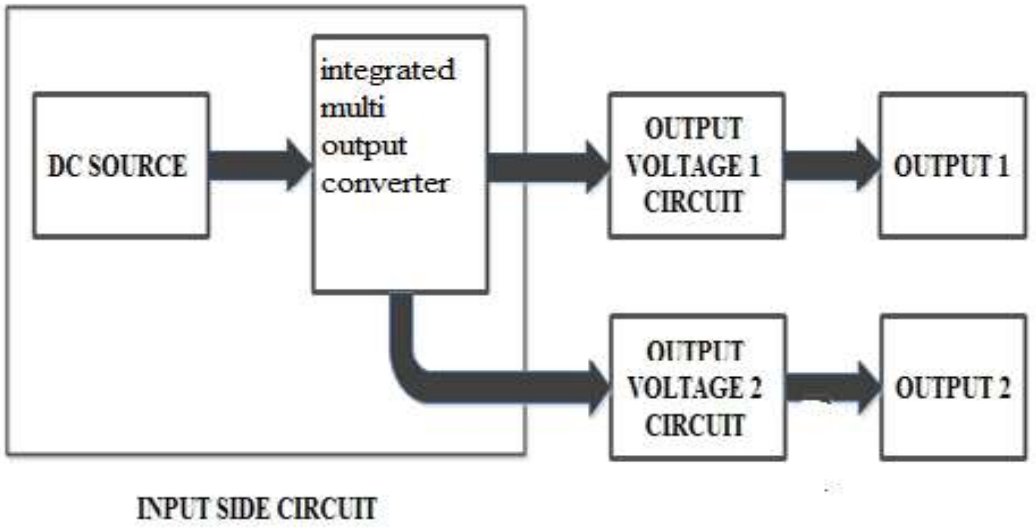

Figure 1: Block diagram integrated SIDO Converter

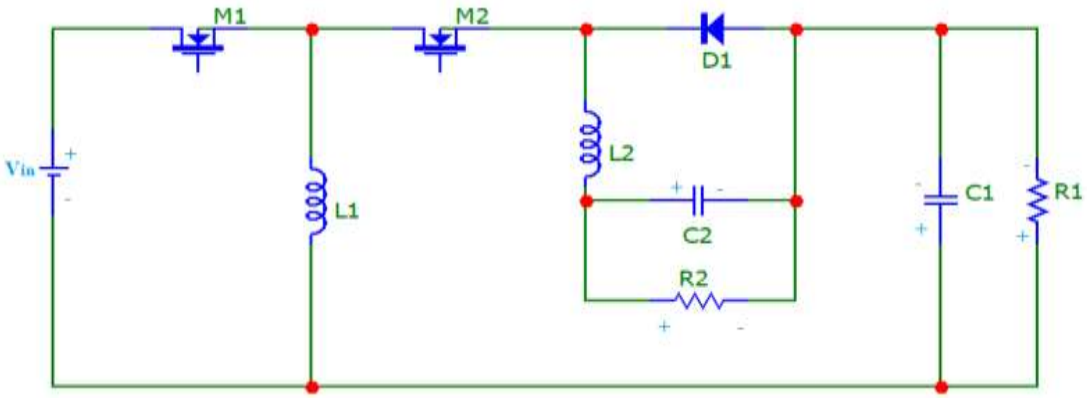

Figure 2: Circuit diagram integrated SIDO Converter

II.LITERATURE SURVEY

Xueshan Liu, JianpingXu, Member, Zhangyong Chen and Nan Wang . In **t**his paper a single-inductor dual-output (SIDO) buck-boost power factor converter is operated by critical conduction mode. Each of the single input dual output buck boost converter output can be regulated by the multiplexing a singly inductor. The SIDO buck-boost PFC converter has overall cost saving, small size and light weight as compared with a conventional two stage multiple output converter. Due to the power conversion, the efficiency of the SIDO buck boost PFC converter can be improved. The characteristics and control strategy of this converter analysed using the experimental results the efficiency, power factor, total harmonic distortion (THD) and accuracy of the output are verified.

Olive Ray, Student Member, Anil Prasad Josyula, Santanu Mishra, and Avinash Joshi Inthis paper a single-input-multi-output (SIMO) dc-dc converter is operated by continuous conduction and dis continuous conduction mode. Each output of the converter can be regulated by step-up and step-down the output voltage. These converters are used with two switches. First switch is used to control the boost converter and using the second switch to generate the second output buck output. Due to the converter control operation is easy the integrated converter. The steady state and dynamic

characteristics are similar to the conventional buck and boost converters and the controlled method is all as same as that of separate converters, with every output being regulated by continuously. The operation of these converters has been explained in this paper using the integrated dual-output converter (IDOC), which has a step-up and a step-down output. The steady-state and dynamic characteristics of the converter studied in this paper. And the closed loop control system is explained in this paper for the converter regulation of both the outputs. The operation of the converter are experimentally validated in 120 W sample. Thus the converter has achieved good cross-regulation to the load change as well as dynamic process of the other output. Finally the measured efficiency of the IDOC model are about 90%.

Jae-Kuk Kim, Seong-Wook Chong-Eun Kim, and Gun-Woo Moon A new standby structure where the standby fly back converter is integrated with the zero voltage- switching (ZVS) multi-output full-bridge dc–dc converter is delivered by this paper. The auxiliary output full bridge converter is used for the standby output in normal mode. By the experimental result from the 12 V/58 for dc to dc output and 5 V/3.2 A for the standby output prototype. The validity of this structure is confirmed.

Ming Shang, Haoyu Wang — A novel integrated dc/dc topology with a step-up output and a step-down output derived by this paper. To regulate both outputs simultaneously a new control scheme has developed. Due to the reuse of components this integrated converter utilize lower number of switches compare with discrete configurations. The characteristics of the converter has studied. It is proved that reduced switching losses all the MOSFET are turned on and off. The converter presents a high boost ratio and is able to clamp the switch voltage spikes the step up stage. The steady-state characteristics and dynamic performances are similar to the conventional buck converter in the step down stage. The single-input-multiple-output (SIMO) version of converter can be derived, when the step down output port can be extended to multiple port. The prototype of the 250 W, 42 V to 390 V and 15 V has designed and tested.The increasing consumer electronics, most of which are natively dc loads, demand efficient power conversion from input ac grid to dc loads. Good power quality and unity power factor (UPF) for maintaining a stable grid can be achieved using power factor correction (PFC) circuits. This article proposes a family of single-input multiple-output (SIMO) rectifiers, which can provide one dc output higher and multiple dc outputs lower than the peak voltage of the ac input. Compared to separate conventional rectifiers at every point-of-load, each with a boost-based PFC circuit followed by a buck converter, the proposed topology requires a less number of switches and has inherent shoot-through protection. In this article, the operation of an N-output (N-switch) rectifier is explained, and its general large-signal and small-signal models are developed. It is further illustrated using a single-input dual-output (SIDO) rectifier. Of the two dc outputs, one dc output voltage is higher, and one is lower than the peak voltage of the ac input. The small-signal model and the control scheme to enforce output voltage regulation and UPF operation are discussed.

Sen Song, GuipengChen,Yuwei Liu, Yihua Hu, Kai Ni, and Yangang Wang,(2019)With the increasing demand of applications that have two different output voltages, the single-input dual-output (SIDO) converter with fewer components is becoming the cost-effective option instead of employing two single-input single-output converters. However, the cross regulation of different outputs is still a challenge in SIDO converters design. To save cost and obtain improved cross regulation performance, a novel SIDO converter consisting of three active switches is proposed in this paper. Owing to the use of a voltage multiplier circuit, a high step-up voltage conversion ratio is achieved with relatively low voltage stress of switches. Thanks to the independent power flow and two control variables, the cross regulation performance is improved, and simultaneous buck as well as boost output voltages are realized. Additionally, all switches can achieve zero-voltage switching operation, which contributes to a significant switching loss reduction. The operation characteristics, design considerations, and control strategy of the proposed converter are analyzed.

Guipeng Chen, Zhufeng Jin, Yan Deng, Xiangning He (2018) In applications that demand single-input dual output (SIDO) or dual-input single-output (DISO) dc–dc converters, employing two separate single-input single-output (SISO) converters is a solution. However, the number of components is doubled, resulting in high overall cost. In order to reduce costs, this paper proposes a novel topology synthesis methodology, with which a variety of SIDOand DISO dc–dc converters with reduced components can be derived. The principle of topology synthesis states that integrated SIDO

and DISO dc–dc converters can be easily developed from conventional SISO converters by replacing a diode with a basic cell inclusive of additional input/output port. The principle is effective for many SISO dc–dc converters, and as an example, topology synthesis based on buck, boost, buck–boost, Cuk, sepic, and zeta SISO converters is performed in this paper. In order to achieve better understanding of the proposed converters, the integrated SIDO Cuk converter is specifically analysed and experimentally verified. In comparison with the conventional scheme of two separate SISO Cuk converters, good cross regulation is retained while the number of diodes, inductors, and capacitors is reduced in the proposed SIDO Cuk converter. In addition, zero-voltage-switching operation of one switch is achieved, contributing to lower switching losses. Finally, a prototype circuit with 48-V input and 156 V/1 A, 24 V/4.A outputs is built to validate the theoretical analysis.

Amir Ganjavi, HodaGhoreishy, and Ahmad Ale Ahmad. This paper proposes a novel non-isolated single-input dual-output three-level dc-dc converter (SIDO-TLC) appropriate for medium and high voltage applications. The SIDO-TLC is an integration of the three-level buck and boost converters, whose output voltages are regulated simultaneously. Reducing voltage stress across semiconductor devices, improving efficiency, and reducing inductors size are among the main merits of the new topology. Moreover, due to the considerably reduced volume of the step-down filter capacitor, a small film capacitor can be used instead, whose advantages are lower ESR and a longer lifespan. A closed-loop control system has been designed based on a small-signal model derivation in order to regulate the output voltages along with the capacitors' voltage balancing. In order to verify the theoretical and simulation results, a 300 W prototype was built and experimented. The results prove the afore-mentioned advantages of the SIDO-TLC, and the high effectiveness of the balancing control strategy. Furthermore, the converter shows very good stability, even under simultaneous step changes of the loads and input voltage.

Weimin Wu, Houqing Wang, Yuan Liu, Min Huang, and FredeBlaabjerg(2016) Due to the widely used DC characterized loads and more distributed power generation sources, the DC Nano-grid becomes more and more popular and it is seen as an alternative to the AC-grid. For safety considerations, the DC Nano-grid should provide reliable grounding for the residential loads like the low voltage AC power system. There are three typical grounding configurations for a DC Nano-grid, including the united grounding, the unidirectional grounding and the virtual isolated grounding. Each grounding configuration has its own specifications to AC/DC converters. In this letter, a dual Buck-Boost AC/DC converter for use in the united grounding configuration based DC Nano-grid with three terminal outputs is proposed. The working principle of this converter is presented in details through analysing the equivalent circuits. Experiments are carried out to verify the theoretical analysis.

S. Singh, B. Singh, G. Bhuvaneswari and V. Bist Multiple-output Switched Mode Power Supplies (SMPSs) for personal computers (PCs) normally depict extremely bad power quality indices at the utility interface such as total harmonic distortion of the input current being more than 80%, power factor being lower than 0.5 and output voltage regulation being very poor. They violate the limits of harmonic emissions set by international power quality standards. In this paper, a nonisolated power factor corrected (PFC) converter is being proposed to be used at the front end to improve the power quality of an SMPS for a PC. The front-end converter is able to reduce the 100-Hz ripple in its output that is being fed to the second stage isolated converter. The performance of the front-end Zeta converter is evaluated in three different operating conditions to select the best operating condition for the proposed SMPS system. The performance of the proposed SMPS is simulated and a laboratory prototype is developed to validate its performance. Test results are found to be in line with the simulated performance under varying input voltages and loading conditions and all the results demonstrate its enhanced performance.

A. Urtasun and D. D. Lu(2015) In this paper, the two-input buck converter is proposed as the dc/dc stage for photovoltaic (PV) cascaded converters. This converter is attractive for this application because it is cost effective and reliable

III.CONCLUSION

The study on proposed integrated SIDO operation over wide load range is made in this paper. The result, switching losses were reduced in some references. The two output voltages are, regulated by two duty-cycles of switches, and thus good cross-regulation can be obtained. It is noted that current stress of converter is increase as compare to conventional converter. The overall

control techniques are also analyzed in this paper. A better understanding of the proposed converter is achieved.

REFERENCES

[1]. S. K. Rastogi, M. S. Rana and S. K. Mishra, "A Single-Input Multiple-Output Unity Power Factor Rectifier," in IEEE Transactions on Power Electronics, vol. 36, no. 9, pp. 10127-10141, Sept. 2021, doi: 10.1109/TPEL.2020.3045130.Ashhab,

[2]. S. Song, G. Chen, Y. Liu, Y. Hu, K. Ni and Y. Wang, "A Three-Switch-Based Single-Input Dual-Output Converter With Simultaneous Boost & Buck Voltage Conversion," in IEEE Transactions on Industrial Informatics, vol. 16, no. 7, pp. 4468-4477, July 2020, doi: 10.1109/TII.2019.2944872.

[3]. G. Chen, Z. Jin, Y. Deng, X. He and X. Qing, "Principle and Topology Synthesis of Integrated Single-Input Dual-Output and Dual-Input Single-Output DC–DC Converters," in IEEE Transactions on Industrial Electronics, vol. 65, no. 5, pp. 3815-3825, May 2018, doi: 10.1109/TIE.2017.2760856.

[4]. A. Ganjavi, H. Ghoreishy and A. A. Ahmad, "A Novel Single-Input Dual-Output Three-Level DC–DC Converter," in IEEE Transactions on Industrial Electronics, vol. 65, no. 10, pp. 8101-8111, Oct. 2018, doi: 10.1109/TIE.2018.2807384.

[5]. W. Wu, H. Wang, Y. Liu, M. Huang and F. Blaabjerg, "A Dual-Buck–Boost AC/DC Converter for DC Nanogrid With Three Terminal Outputs," in IEEE Transactions on Industrial Electronics, vol. 64, no. 1, pp. 295-299, Jan. 2017, doi: 10.1109/TIE.2016.2598804.

[6]. O. Ray, A. P. Josyula, S. Mishra and A. Joshi, "Integrated Dual-Output Converter," in IEEE Transactions on Industrial Electronics, vol. 62, no. 1, pp. 371-382, Jan. 2015, doi: 10.1109/TIE.2014.2327599.

[7]. X. Liu, J. Xu, Z. Chen and N. Wang, "Single-Inductor Dual-Output Buck–Boost Power Factor Correction Converter," in IEEE Transactions on Industrial Electronics, vol. 62, no. 2, pp. 943-952, Feb. 2015, doi: 10.1109/TIE.2014.2334659.

[8]. M. Shang and H. Wang, "A ZVS integrated single-input-dual-output DC/DC converter for high step-up applications," 2016 IEEE Energy Conversion Congress and Exposition (ECCE), 2016, pp. 1-6, doi: 10.1109/ECCE.2016.7854810.

[9]. J. Kim, S. Choi, C. Kim and G. Moon, "A New Standby Structure Using Multi-Output Full-Bridge Converter Integrating Flyback Converter," in IEEE Transactions on Industrial Electronics, vol. 58, no. 10, pp. 4763-4767, Oct. 2011, doi: 10.1109/TIE.2011.2106101.

[10]. S. Singh, B. Singh, G. Bhuvaneswari and V. Bist, "Power Factor Corrected Zeta Converter Based Improved Power Quality Switched Mode Power Supply," in IEEE Transactions on Industrial Electronics, vol. 62, no. 9, pp. 5422-5433, Sept. 2015, doi: 10.1109/TIE.2015.2415752.

[11]. A. Urtasun and D. D. Lu, "Control of a Single-Switch Two-Input Buck Converter for MPPT of Two PV Strings," in IEEE Transactions on Industrial Electronics, vol. 62, no. 11, pp. 7051-7060, Nov. 2015, doi: 10.1109/TIE.2015.2432097.

[12]. H. Sarnago, Ó. Lucía, M. Pérez-Tarragona and J. M. Burdío, "Dual-Output Boost Resonant Full-Bridge Topology and its Modulation Strategies for High-Performance Induction Heating Applications," in IEEE Transactions on Industrial Electronics, vol. 63, no. 6, pp. 3554-3561, June 2016, doi: 10.1109/TIE.2016.2530780.