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A Hybrid Resonant ZCS PWM Converter for Photovoltaic Energy Sources Using Bat Algorithm

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ABSTRACT: An approach of zero-current-switching (ZCS) for main switches are presented in this project. Different from the large turn-off current of main switches of the conventional zero-voltage and zero-current-switching (ZVZCS) full-bridge (FB) dc-dc converter, small turn-off current of auxiliary circuit is introduced to achieve ZCS for main switches, where the auxiliary circuit also delivers a small portion power and can realize ZVZCS. Hence, high efficiency can be achieved with the switching loss lowered remarkably. Furthermore, a hybrid resonant FB dc-dc converter is proposed, the operation principle and parameters design rules of which are analyzed in detail. A experimental platform has been built to verify the feasibility and performance of the proposed ZCS approach, as well as the proposed converter.

I. INTRODUCTION

The medium-voltage DC (MVDC) collection technology presents several significant advantages such as high efficiency, light system weight, high controllability, no reactive power. The non-isolated DC-DC converters for renewable energy sources based on MVDC collection systems can be accessed in, which have the advantage of low component power rating. There are two soft-switching technique types for conventional FB converters namely the zero-voltage-switching (ZVS) and the zero-voltage and zero current-switching (ZVZCS). The resonant switched-capacitor converter proposed in is characterized by the soft-switching condition (ZVS) for all switches and diodes, leading to reduced switching losses and high efficiency.

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II. RELATED WORK

The Existing System MPPT and the voltage balancing control methods for three-level boost-type converter. The Existing sampling strategy, the information of the PV power and the voltage imbalance can be provided for the

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proposed control methods. The PV power *P*PV is the product of the PV current *i*PV and the PV voltage *v*PV. By neglecting the power loss of the three level boost converter, the PV power can also be expressed as the product of the dc-bus voltage *V*dc.

They are physically larger for the same capacitance and working voltage as other types. They have a higher leakage current than most other types. They are not very good for low frequency applications. They can only be mounted vertically because of the liquid electrolyte inside them.

III. METHODS

A relieve the tail current effect of MOSFETs which are preferred in high power applications, an approach of zero-current-switching (ZCS) for main switches is presented in this project. Different from the large turn-off current of main switches of the conventional zero-voltage and zero-current-switching (ZVZCS) full-bridge (FB) DC-DC converter, small turn-off current of auxiliary circuit is introduced to achieve ZCS for main switches, where the auxiliary circuit also delivers a small portion power and can realize ZVZCS. Hence, high efficiency can be achieved with the switching loss lowered remarkably. Furthermore, a hybrid resonant FB dc-dc converter is proposed, the operation principle and parameters design rules of which are analyzed in detail. A 12 V-35V experimental platform has been built to verify the feasibility and performance of the proposed ZCS approach, as well as the proposed converter.

ZCS PWM CONVERTER:

DC to DC converters are important in portable electronic devices such as cellular phones and laptop computers, which are supplied with power from batteries primarily. Such electronic devices often contain several sub-circuits, each with its own voltage level requirement different from that supplied by the battery or an external supply (sometimes higher or lower than the supply voltage). Additionally, the battery voltage declines as its stored power is drained. Switched DC to DC converters offer a method to increase voltage from a partially lowered battery voltage thereby saving space instead of using multiple batteries to accomplish the same thing.

Most DC to DC converters also regulate the output voltage. Some exceptions include high-efficiency LED power sources, which are a kind of DC to DC converter that regulates the current through the LEDs, and simple charge pumps which double or triple the input voltage.

Switched-mode conversion

Electronic switch-mode DC to DC converters convert one DC voltage level to another, by storing the input energy temporarily and then releasing that energy to the output at a different voltage. The storage may be in either magnetic field storage components (inductors, transformers) or electric field storage components (capacitors). This conversion method is more power efficient (often 75% to 98%) than linear voltage regulation (which dissipates unwanted power as heat). This efficiency is beneficial to increasing the running time of battery operated devices. The efficiency has increased since the late 1980s due to the use of power FETs, which are able to switch at high frequency more efficiently than power bipolar transistors, which incur more switching losses and require a more complicated drive circuit. Another important innovation in DC-DC converters is the use of synchronous rectification replacing the flywheel diode with a power FET with low "on resistance", thereby reducing switching losses. Before the wide

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availability of power semiconductors, low power DC to DC converters of this family consisted of an electro-mechanical vibrator followed by a voltage step-up transformer and a vacuum tube or semiconductor rectifier.

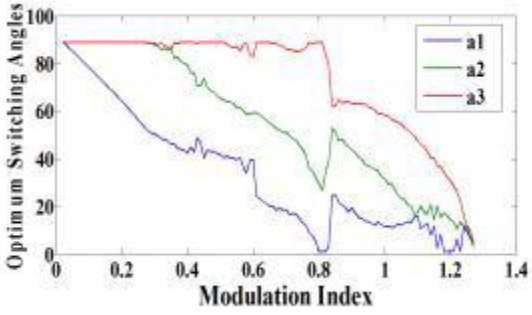
Most DC-to-DC converters are designed to move power in only one direction, from the input to the output. However, all switching regulator topologies can be made bi-directional by replacing all diodes with independently controlled active rectification. A bi-directional converter can move power in either direction, which is useful in applications requiring regenerative braking.

Drawbacks of switching converters include complexity, electronic noise (EMI / RFI) and to some extent cost, although this has come down with advances in chip design.

DC-to-DC converters are now available as integrated circuits needing minimal additional components. They are also available as a complete hybrid circuit component, ready for use within an electronic assembly.

BAT ALGORITHM:

If we idealize some of the echolocation characteristics of microbars, we can develop various bat-inspired algorithms or bat algorithms. For simplicity, we now use the following approximate or idealized rules:



1. All bats use echolocation to sense distance, and they also ‘know’ the difference between food/prey and background barriers in some magical way;
2. Bats fly randomly with velocity vi at position xi with a fixed frequency fmin, varying wavelength _ and loudness A0 to search for prey. They can automatically adjust the wavelength (or frequency) of their emitted pulses and adjust the rate of pulse emission r 2 [0, 1], depending on the proximity of their target
3. Although the loudness can vary in many ways, we assume that the loudness varies from a large (positive) A0 to a minimum constant value A min.

IV. RESULT AND DISCUSSION

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complimentary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.

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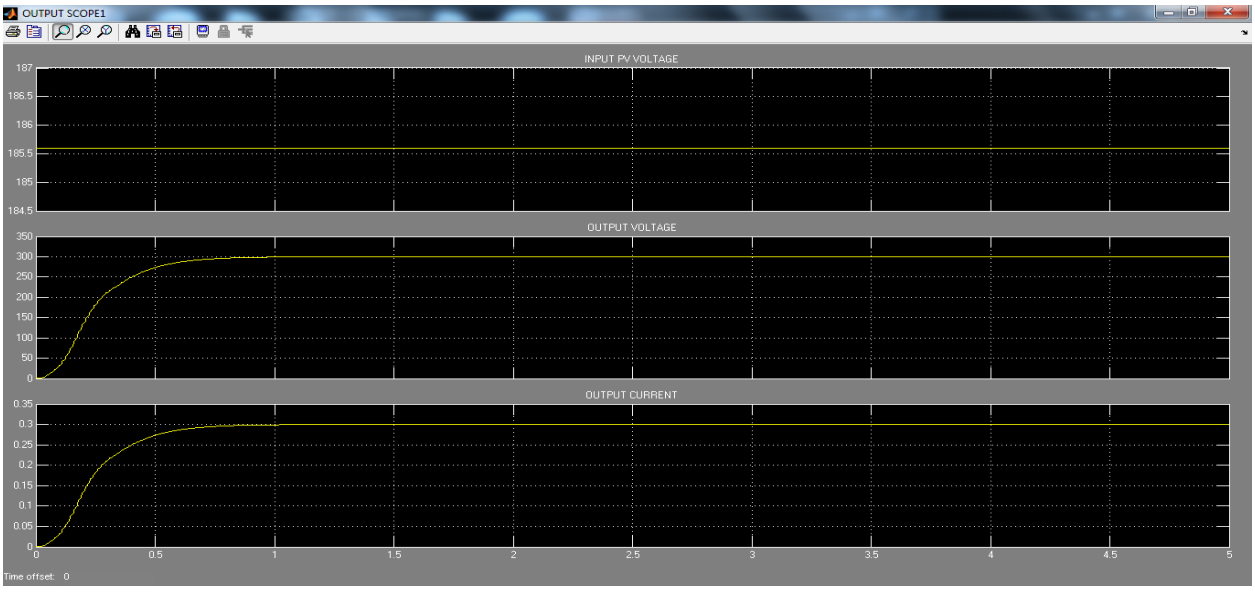
The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

PV VOLTAGE AND CURRENT:



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V. CONUCLUSION

This paper proposes an approach of ZCS for IGBTs by replacing the conventional large turn-off current of main switches of FB converter with small turn-off current of auxiliary circuit, where the auxiliary circuit also delivers a small portion power. And the power distribution between the main and auxiliary circuits can be designed and is only determined by the turn's ratio of main transformer. Based on the ZCS approach, a hybrid resonant PWM FB dc-dc converter is derived, which can achieve ZCS for all main switches adopting IGBTs. The voltage stress of auxiliary switches is half of that of main ones so that MOSFETs can be chosen for auxiliary switches. Moreover, ZVZCS turn-on can be realized for auxiliary MOSFETs. Hence, the switching loss can be significantly reduced and high efficiency can be obtained. The operation principle and design rules for main parameters of the proposed PWM FB converter are discussed in detail, which have been verified by the experimental results. At last, high experimental efficiency is achieved over wide load range. It is true that there are problems to be solved to realize practical high power dc collection systems .For instance, the high power medium frequency transformer design is of significance and requires extensive studies.

REFERENCES

[1] C. Rahmann, V. Vittal, J. Ascui, and J. Haas, "Mitigation control against partial shading effects in large-scale PV power plants," *IEEE Trans. Sustainable Energy*, vol. 7, no. 1, pp. 173–180, Jan. 2016.
[2] Global Wind Energy Council:Market Forecast for 2015-2019, http://www.gwec.net/global-figures/market-forecast-2012-2016/
[3] S. Cui, N. Soltau, and R. W. De Doncker, "A high step-up ratio soft-switching DC-DC converter for interconnection of MVDC and HVDC grids," *IEEE Energy Conversion Congress and Exposition (ECCE)*, 2016, pp. 1–8.
[4] C. Meyer, "Key components for future offshore DC grids," Ph.D. dissertation, Faculty of Electrical Engineering and Information Technology, RWTH Aachen Univ., Aachen, Germany, 2007.
[5] Y. Chen, Z. Li, S. Zhao, X. Wei,and Y. Kang, "Design and implementation of a modular multilevel converter with hierarchical redundancy ability for electric ship MVDC system," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 5, no. 1, pp.189–202, Mar.2017.
[6] H. Athab, A. Yazdani, and B. Wu, "A transformerless DC-DC converter with large voltage ratio for MV DC grids," *IEEE Trans. Power Del.*, vol. 29, no. 4, pp. 1877–1885, Aug. 2014.
[7] M. Prudente, L. L. Pfitscher, G. Emmendoerfer, E. F. Romaneli, and R. Gules, "Voltage multiplier cells applied to non-isolated DC-DC converters," *IEEE Trans. Power Electron.*, vol. 23, no. 2, pp. 871–887, Mar. 2008.
[8] W. Chen, A. Q. Huang, C. Li, G. Wang, and W. Gu, "Analysis and comparison of medium voltage high power DC/DC converters for offshore wind energy systems," *IEEE Trans. Power Electron.*, vol. 28, no. 4, pp. 2014–2023, Apr. 2013.