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Design and Implementation of High Efficiency Asymmetric Forward-Flyback Converter

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ABSTRACT

This paper presents an approach to efficiency optimization in digitally controlled flyback dc–dc converters over wide ranges of operating conditions. Efficiency is characterized and optimized based on power loss modeling and multivariable nonlinear constrained optimization over power-stage and controller parameters. A valley switching technique is adopted to reduce MOSFET turn-on switching loss in discontinuous conduction mode. An optimization procedure is formulated to minimize power loss weighted over a range of operating points, under a cost constraint. A lookup table-based digital controller is applied to achieve on-line efficiency optimization by programming switching frequencies and operating modes based on the efficiency optimization processes. The proposed on-line efficiency optimization approach is verified by experimental results on a low cost 65 W flyback dc–dc prototype.

INTRODUCTION

Converter is an electrical device that convert the voltage from alternating current (AC) to direct current (DC). In industry sector the converters are plays an important role. Non-isolated bidirectional dc-dc converters (BDCs) with capacity of transferring power in both directions, have been widely employed in various industrial applications, such as uninterruptable power supplies, electric vehicles and so on. BDCs can be simply derived from unidirectional dc-dc converters by replacing diodes with switches and thus in the hard-switching BDCs, high switching losses are similarly caused by hard-switching operation. Moreover, with the increase of switching frequency, the losses further deteriorate. In order to effectively minimize the switching losses in the converter, many soft switching techniques have been proposed, such as zero-voltage switching (ZVS) converters with large inductor ripple current, active-clamping ZVS converters, zero-voltage-transition (ZVT) converters and ZVS converters with coupled inductors [1-5].

In multiphase interleaved bidirectional converters with large inductor ripple current were proposed to achieve ZVS operation for switches without additional components. However, the large inductor ripple current will significantly increase conduction losses in each converter and decrease the efficiency consequently, especially at light load condition. Although adaptive frequency modulation was presented in to reduce the conduction losses, penalty on control complexity is introduced. Moreover, the ZVS realization method is not suitable for non-interleaved applications with only single converter because large input/output filters are required [6-10].

In order to achieve soft-switching operation and eliminate the stringent requirement of filters, an active-clamping converter was proposed in, in which both main switches and auxiliary switch are ZVS. As a result, low switching losses are obtained. Unfortunately, large current circulates in

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the auxiliary circuit and voltage stresses of switches increase, resulting in high conduction losses. In, an auxiliary resonant circuit is employed to achieve low circulating current. But the auxiliary switch is nearly hard-switching.

ZVT bidirectional converters are very attractive because of their soft-switching operation, low voltage stresses and high efficiency. The auxiliary circuit is removed out of the main circuit and is only activated in a short interval, hence additional conduction losses are small. Besides, the auxiliary switches are zero-current turned on and zero voltage turned off in, which are further improved in with zero-current turn-on as well as turn-off. Nevertheless, ZVT converters need additional magnetic cores to implement auxiliary resonant inductors, resulting in increased cost.

The additional magnetic cores are eliminated in the ZVS dc-dc converters with coupled inductors, which utilize the leakage inductor to function as the auxiliary resonant inductor. The operation is similar with that of ZVT converters, and thus soft-switching operation as well as improved efficiency are also attained. In, a family of magnetic coupling bidirectional dc-dc converters was derived, which can achieve ZVS operation in both power flow directions. Unfortunately, two extra diodes are required in series connection with two auxiliary switches to implement unidirectional switches. The extra diodes are eliminated in the ZVS magnetic coupling bidirectional converters. Meanwhile, advantages of soft-switching operation and reduced magnetic core.

However, only one specific ZVS magnetic coupling topology has been proposed for different dc-dc converters, while optional topologies should be provided for engineers to choose an optimum one according to the requirement in different practical applications. Therefore, this paper aims to explore and provide more alternative topologies. Based on the topology derivation methodology, 13 different viable ZVS magnetic coupling bidirectional buck/boost topologies are firstly obtained in the paper, including the converter presented. With different auxiliary circuit connections, the converter performance characteristics are similar but with some differences and thus are preferred in different applications. In order to simplify the selection process of an optimal topology for a specific application, generalized analysis is also provided in the paper, from which the performance characteristic of each converter can be easily obtained

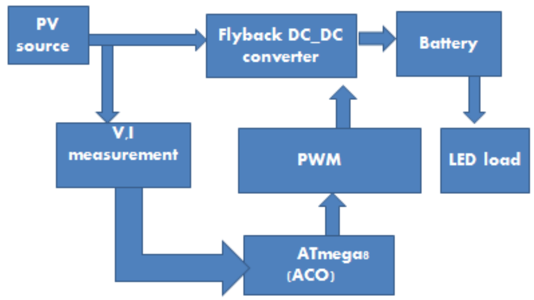
D- VSI Based Voltage Regulation and Harmonic Damping

This paper discusses a shunt active filter intended for installation on a power distribution system. The active filter has an additional capability to regulate the distribution line voltage by means of adjusting reactive power. Theoretical analysis investigates the dynamic performance of combined harmonic damping and voltage regulation. As a result, harmonic damping makes it possible to improve the stability of the control loop for voltage regulation, and the combined harmonic damping. The system with control scheme is implemented in Matlab/Simulink. The simulation results are shown to verify the effectiveness of the combined harmonic damping and voltage regulation

Modern Reactive Power and Higher Harmonic Compensation through the Utilization of Vsi and Efa Dynamic Compensators.

This article discusses the issue of reactive power and higher harmonic compensation by means of classic systems based on capacitor batteries and modern power electronics dynamic systems of the VSI and EFA type. The author, through the process of evaluating advantages and disadvantages, is strongly in favour of the modern dynamic solutions and underlines their benefits and usability in the attempts aimed at improving the quality and efficiency of electric energy usage

BLOCK DIAGRAM OF PROPOSED SYSTEM



Ant colony optimization is a technique for optimization that was introduced in the early 1990's. The inspiring source of ant colony optimization is the foraging behavior of real ant colonies. This behavior is exploited in artificial ant colonies for the search of approximate solutions to discrete optimization problems, to continuous optimization problems, and to important problems in telecommunications, such as routing and load balancing. First, we deal with the biological inspiration of ant colony optimization algorithms. We show how this biological inspiration can be transferred into an algorithm for discrete optimization. Then, we outline ant colony optimization in more general terms in the context of discrete optimization, and present some of the nowadays best performing ant colony optimization variants. After summarizing some important theoretical results, we demonstrate how ant colony optimization can be applied to continuous optimization problems. Finally, we provide examples of an interesting recent research direction: The hybridization with more classical techniques from artificial intelligence and operations research.

Problem solving technique

- We implemented ACO controller for estimation of harmonics and voltage ripples in DC line so dynamic response of ACO control is quick
- Then harmonics is low and DC grid voltage is more accurate

RESULTS

Input DC

Output DC grid voltage

CONCLUSION

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it good, reliable and affordable solution for electricity generation.

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