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Implementation of PWM Soft Single Switched DC-DC Converters with Coupled Inductors

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ABSTRACT

This paper proposes a novel family of pulse width modulation of soft-single-switched dc-dc converters without high voltage and current stresses. These converters do not require any extra switch to achieve soft switching, which considerably simplifies the control circuit. In all converter family members, the switch is turned on under zero-current condition and is turned off at almost zero-voltage condition. From the proposed converter family, the boost topology is analyzed, and its operating modes are explained. The proposed circuit is simulated using MATLAB/Simulink.

Keywords: ***dc to dc converter, pwm, boost converter, pi controller***

I .INTRODUCTION

In order to reduce the size and weight of switching converters and increase power density, a high switching frequency is required. However, in hard-switching converters, as the switching frequency increases, switching losses and electromagnetic interference increase. To solve this problem, soft-switching converters are indispensable. In recent years, great amount of research is done to develop soft-switching techniques in dc-dc converters. In these converters, it is desirable to control the output voltage by pulse width modulation (PWM) because of its simplicity and constant frequency. A low number of components, particularly active components, is also desirable. Quasi-resonant converters do not have any extra switch to provide soft-switching conditions; however, they must be controlled by the variation of switching frequency. Furthermore, zero-voltage transition, zero-current transition, and active clamped converters are PWM controlled but require at least two switches, which increases the complexity of power and control circuits. PWM soft-single-switched (SSS) converters and lossless passive snubbers, enjoy all the mentioned advantages, usually at the cost of additional current and voltage stresses. However, they usually have a large number of passive elements, which makes the converter implementation difficult. The lossless passive snubber circuit is simple and easy to implement. However, in this converter, a soft-switching condition is not achieved for the switch turnoff instant. Furthermore, an additional diode is added in the main power path, which would further increase the converter conduction losses. In this project, a family of PWM SSS converters without any substantial increase in voltage and current stresses is presented. Furthermore, in this converter family, the number of additional components is not high. The switch in all proposed converters is turned on under zero-current-switching (ZCS) condition and is turned off at almost zero-voltage-switching (ZVS) condition. The converter main diode turns on under ZVS condition and turns off under zero-voltage zero-current switching (ZVZCS) conditions. Furthermore, an auxiliary diode turns on under ZVS condition and turns off under ZCS condition. The proposed method can be easily applied to single-switch converters such as buck, boost, and buck-boost. Cuk, SFP1C, and Zeta. Furthermore, it can be applied to isolated single-switch converters such as

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