A Single-Stage LED Driver Based on Interleaved Buck-boost Circuit and LLC Resonant Converter

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ABSTRACT

A single-stage LED driver based on interleaved buck-boost circuit and LLC resonant converter is proposed. The buck-boost circuit and LLC resonant converter are integrated by sharing switches, which can decrease the system cost and improve system efficiency. The input voltage of the buck-boost circuit is half of the rectified voltage, and two buck-boost circuits are formed with the two half-bridge switches and corresponding diodes. The two buck-boost circuits work in interleaved mode and the inductor current is in discontinuous conduction mode, both helping to achieve the power factor correction. The half-bridge LLC resonant converter is adopted here, and the soft switching characteristic of the LLC resonant converter is not changed by the switch integration. The primary-side switches still work in zero voltage switching (ZVS) mode, and the secondary diodes still work in zero current switching (ZCS) mode, which both reduce the switching losses and improve the efficiency of the system.

Keywords: Interleaved buck-boost circuit, LLC resonant converter, power factor correction.

INTRODUCTION

Compared with traditional lighting sources, the High-Brightness LED (HB-LED) has many advantages, such as energy savings, long lifetime, high reliability, pure light color, fast response, and friendliness to the environment. In the future, traditional HID lamps will inevitably be replaced by LEDs. With the development of packaging and coating technologies, LED prices are gradually declining, and they are widely used in automotive electronics, street lighting, and LCD backlighting. circuits work in interleaved...
The two buck-boost mode, which achieves high PF and low THD; at the same time, the bus voltage is low, exceeding the input voltage by only a small amount. The soft switching characteristic is not changed by sharing switches. Compared with the conventional two-stage converter based on an interleaved buck-boost PFC stage and LLC DC/DC stage, the proposed single-stage circuit reduces two MOSFETs and one control IC, which greatly reduces the system cost. In addition, the proposed single-stage circuit needs to adjust only the switches’ working frequency to regulate the output current, and the PFC function is achieved naturally. Thus, the system control method is greatly simplified and its robustness is improved.

EXISTING SYSTEM

Among these converters based on an LLC circuit, the system efficiency is highly improved.

However, traditional LED drivers based on LLC circuits still have high cost because an additional PFC circuit is needed.

CIRCUIT DIAGRAM

PROPOSED SYSTEM

- A novel single-stage LED driver based on a
  The input voltage is divided and forms two buck-boost circuits with two half-bridge switches and corresponding diodes.
- The proposed converter has a totally symmetric structure, and therefore, the voltage and the current stress caused by the switch integration can be shared completely.
- The two buck-boost circuits work in interleaved mode, which achieves high PF and low THD;
  - At the same time, the bus voltage is low, exceeding the
  - input voltage by only a small amount.
  - The soft switching characteristic is not changed by sharing switches. Compared with the conventional
  - buck-boost circuit and LLC converter.

BLOCK DIAGRAM
RESULTS

Circuit diagram

Dc output
CONCLUSION

In this paper, a novel single-stage AC/DC converter based on an interleaved buck-boost circuit and LLC resonant circuit is proposed. The converter is used as an LED driver for a street lighting system. By using interleaved technology, the converter can work in high voltage input conditions and effectively achieve PFC. In addition, the LLC circuit can make the system work in soft switching mode, which improves the system efficiency.

REFERENCE

