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Implementation of A High Power Factor Led Driver Based On Slide Mode Controlled Interleaving Integrated Buck Flyback Converter

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Abstract
Nowadays, the use of high brightness light emitting diode (HB - LED) is increasing in a lot of outdoor lighting applications such as street lights, floodlights, beacon lights, tunnel lights and security lights, because of its high luminous- efficacy, ease to drive, absence of a mercury problem and long lifetime. LED'S plays a major role in medical field. For example LED'Sare used in dermatology, endoscopy, radiology, photo therapy. Mercury lamps make harmful to human beings. This work presents a high power factor (PF), slide mode controlled low total harmonic distortion (THD) light-emitting diode (LED) driver with dimming capability. In addition, the proposed technique ensures a high PF and low THD at any dimming level. The driver is implemented by using an interleaved capacitor, which is placed between the rectifier and the integrated buck fly back converter (IBFC) additionally slide mode controller provides attractive features such as fast dynamic response, insensitivity to variations in outputs and external disturbance. MATLAB tool has been used to evaluate our proposed system.

Introduction

Since the 1960s when light-emitting-diodes (LED's) were first developed, they have been replacing little by little the conventional sources of light. Nowadays, they have become the most popular lighting source in a wide variety of applications. This has been possible owing to their longer lifetime, as it is usually quoted as 25000 to 50000 h, as declared by the LED manufacturers and standard organizations. In addition, they present a higher efficacy compared to other sources of lighting. As it is stated in, incandescent lamp efficacy ranges between 14 and 17lm/W, fluorescent tubes' around 100 lm/W and high-pressure- sodium lamp's reaches 120 l m/W. However, the new LED generation will have an efficacy up to 250 lm/W even 300 lm/W. Moreover, LED's exhibit other outstanding features like small size, fast response, robustness, reliability, and color rendering index. However, LED's cannot be connected directly to the mains, due to their low internal impedance, thus they have to be driven through a current controller supply. Inorder to assure the advantages offered by LED's, an electronic converter to drive the LED's should adequately be designed to fulfill all required standards. The conventional drivers proposed to fulfill these standards are two-stage LED drivers. The two-stage drivers are composed of a power- factor correction (PFC) stage and a constant- current controlled dc/dc converter stage. The drawbacks are mainly higher number of components, lower efficiency, and higher number of controlled switches. Thus, it will ensure lower switching losses and require only one driving circuit. These converters keep the good operation of the two stage solution, as well as offer some advantages of the single stage solution.

Related work

Pen Fang proposed LED driver operates as a conventional LED driver that transfers energy from the ac input to LED output, performs power factor correction, and generates the main output voltage. The main output voltage has a double-line-frequency ripple like in a conventional design.

Guirguis Z. Abdelmessih et al presented a high power factor (PF), low total harmonic distortion (THD) light-emitting diode (LED) driver with dimming capability. In addition, the proposed technique ensures a high PF and low THD at any dimming level. The driver is implemented by using an interleaved capacitor, which is placed between the rectifier and the integrated buck fly back converter (IBFC).

Qingcong Hu et al introduced techniques to reduce energy storage in off- line light- emitting diode (LED) drivers. Rather than targeting the ideals of unity input power factor (PF) and constant LED current, a topology is selected to minimize the required energy storage with the more practical targets of 0.9 PF and a selectable LED current ripple.

Hamed Valipour et al proposed circuit has a high-input power factor, high efficiency, a long lifetime, and it produces no flicker. To increase the lifetime of the converter, the proposed circuit does not include any electrolytic capacitors in the power stage.

Hao Wu et al designed a more efficient single- coupled-inductance multiple- output (SIMO) LED driver is proposed. The electrolytic capacitor-less design is targeted for lighting applications with color mixing and color temperature adjustment, where a small capacitance actively balances the power difference between the ac input and multiple dcoutputs.

PROPOSEDSYSTEM SLIDE MODE CONTROL

This work propose a slide mode interleaved integrated buck-fly back converter (IIBFC) solves this issue as it ensures a good performance within all the operation range.

The IIBFC is made by adding a capacitor between the diode bridge and the IBFC converter.

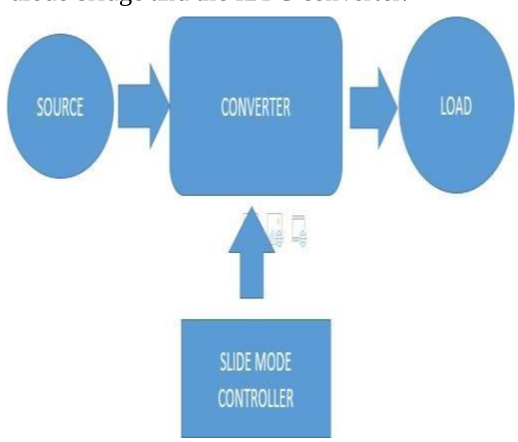

Fig : proposed system

In control systems, sliding mode control, or SMC, is a nonlinear control method that alters the dynamics of a nonlinear system by application of a discontinuous control signal (or more rigorously, a set-valued control signal) that forces the system to "slide" along a cross-section of the system's normal behavior. The state-feedback control law is not acontinuous function of time. Instead, it can switch from one continuous structure to another based on the current position in the state space. Hence, sliding mode control is avariable structure control method. The multiple control structures are designed so that trajectories always move toward an adjacent region with a different control structure, and so the ultimate trajectory will not exist entirely within one control structure. Instead, it will slide along the boundaries of the control structures. The motion of the system as it slides along these boundaries is called a sliding mode[1] and the geometrical locus consisting of the boundaries is called the sliding (hyper)surface. In the context of modern control theory, any variable structure system, like a system under SMC, may be viewed as a special case of a hybrid dynamical system as the system both flows through a continuous state space but also moves through different discrete control modes

SOFTWARE RESULT SIMULINKMODULE

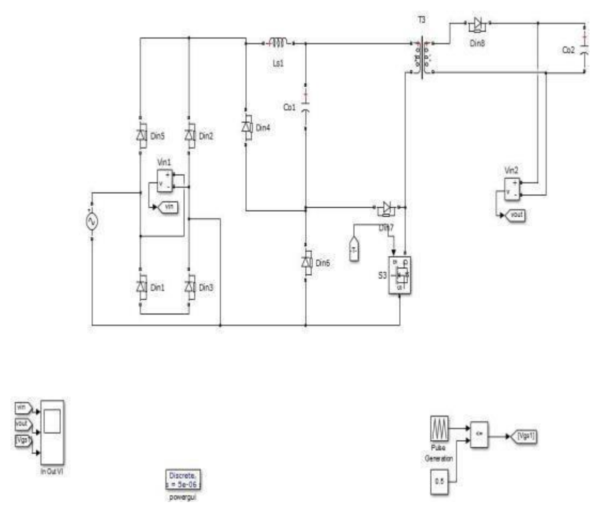

Fig: simu link model

OUTPUT WAVEFORM:

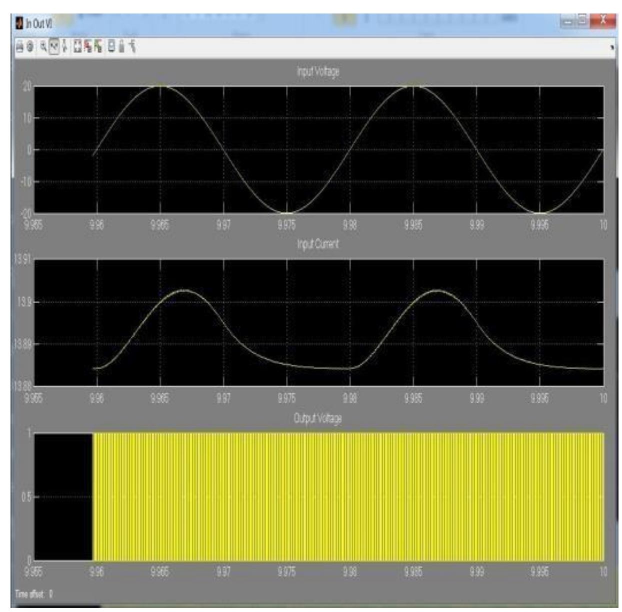

Fig output wave form

HARDWARE RESULT

CONCLUSION

This project presents a new wire-less based monitoring topology that enhances both PF and THD to be well below the limitations specified by the IEC 61000-3-2 standard. Thus the way it increases the efficiency. By increasing LED efficiency we have to use this in various medical applications. This is done by inserting an interleaved capacitor between the rectifier and the converter. Furthermore, the proposed IIBFC reduces the ripple by a factor of five, which means a significant reduction of the output and buck capacitors. Also, the proposed technique avoids any complex circuitry, or any other extra sensors apart from those used in the conventional IBFC, since the control technique is the same as that used forte IBFC. Regarding the power component, the proposed topology offers all these features by only adding an extra winding

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