An AC–DC LED Driver with a Two-Parallel Inverted Buck Topology for Reducing the Light Flicker in Lighting Applications to Low-Risk Levels

Introduction:
Light-emitting diodes (LEDs) have been replacing traditional light sources like incandescent and fluorescent lamps in many lighting applications because LEDs have a wide color gamut, a high luminous efficacy, a long lifetime, and are environment friendly. Most state-of-the-art LED drivers utilizing an offline ac voltage source employ power factor correction (PFC) circuits to comply with standards which specifies that the power factor (PF) should be higher than 0.9 for commercial applications and 0.7 for residential applications.

To meet these requirements, conventional single-stage LED drivers with PFC circuits that reduced the number of discrete components using simple structures with reduced costs and small form factors were reported.

Existing system:
An ac–dc converter with a parallel PFC scheme is proposed. An isolated full-bridge boost converter is employed. For the main power stage where the input power is directly delivered to the output and the remaining of the Power is stored in a storage capacitor. A forward converter is placed in parallel with the boost converter and is used for the auxiliary power stage that provides the necessary power for dc output power by using the storage capacitor as its input source.
Although only the power must be processed twice before being delivered to the output, this architecture requires two isolation transformers that are relatively complex and expensive.

**Dis-advantages:**
- Relatively complex
- Expensive.

**Proposed system:**
An ac–dc LED driver consisting of two parallel inverted buck converters for reducing the light Flicker to low-risk levels is proposed. An ac–dc LED driver that consists of two-parallel inverted buck converters to buffer the twice-line frequency energy, one inverted buck converter (also known as a floating buck converter) conveys energy to a storage capacitor, simultaneously performing the power factor correction. The other inverted buck converter regulates the LED current to maintain a constant brightness in the LEDs for reducing the light flicker to low risk levels.

The proposed architecture reduces the voltage stress and the size of the storage capacitor, enabling the use of a film capacitor instead of an electrolytic capacitor. To handle the power differences between the twice-line-frequency input power and the constant LED power, one inverted buck converter conveys energy from the ac source to a storage capacitor, simultaneously performing the PFC operation. The other inverted buck converter supplies constant current to the LEDs to maintain a constant brightness.

The proposed architecture can achieve an input PF higher than 0.9. Although the proposed approach offers a lower PF than the conventional two-stage approach with a boost PFC converter, the proposed architecture with two inverted buck converters in parallel...
significantly reduces the average voltage. In addition, the two inverted buck converters have a low-side switch that reduces the design complexity of the gate driver circuit. Whereas the second approach employing an RCC, requires a transformer or coupled inductor with several other components.

**Advantages:**
- A low-cost solution.
- Simple design.

**Applications:**
- Low-power LED lighting applications.

**Block Diagram:**