

A Novel PFM/PWM Hybrid Modulated Single-stage FSBB-LLC AC-DC Converter

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Abstract

By integrating the Four Switch Buck-Boost (FSBB) PFC and full-bridge LLC resonant converter, a novel single-stage FSBB-LLC AC-DC converter is proposed. Moreover, a dual-loop feedback control strategy based on PFM/PWM hybrid modulation is proposed for obtaining the desired bus voltage and stable output voltage. The bus voltage feedback loop is utilized to regulate the bus voltage by selecting the boost or buck-boost mode; the output voltage feedback loop is employed to stabilize the output voltage by adjusting the switching frequency or phase shifting angle. Furthermore, an optimal parameter design based on power balance principle is also derived. The experimental results of an 85~300V input, 12V/25A output prototype demonstrate that: (1) low and narrow bus voltage of 240~340V is achieved under the entire input and output condition; (2) the LLC cell operates as a DCX converter over the whole load range as the input voltage exceeds 120V; (3) the output voltage is well regulated even under the no-load condition; (4) ZVS feature for the shared main switches is still maintained; (5) a peak efficiency of 90.9% and PF values above 0.987 are achieved.

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