Study and Improvement of Single-Stage Power Factor Correction Techniques

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(ABSTRACT)

This thesis work focuses on the study and improvement of single-stage power factor correction techniques.

The generalized structures of the present pulse-width-modulation (PWM) integrated single-stage power factor correction (PFC) converters are presented. The typical PFC cells in the single-stage PFC converter are identified. After that, the necessary PFC condition is derived and verified to understand the principle of the single-stage PFC converters.

As an example, the continuous current mode (CCM) current source single-stage PFC converter is studied. The circuit intuitions and design consideration of this converter are presented. Also, an improved current source single-stage PFC converter with a low-frequency auxiliary switch is proposed to overcome the problem of the previous converter. Experimental verification shows the improvement is effective.

To evaluate single-stage PFC technique, a comparison study between the current source single-stage and the boost two-stage PFC converters is done in this thesis. It shows that for universal line application, due to the wide bus-capacitor voltage range, single-stage PFC converters have higher component ratings than two-stage PFC converters. This limits the application of single-stage PFC converter. Therefore, an interesting future work will be how to reduce the bus voltage range of single-stage PFC converters.