中文摘要

本論文探討由降升壓式與返馳式轉換器合併而成之單級高功因電力轉換器。首先介紹單級高功因轉換器之合併演化過程，此轉換器操作在 DCM+DCM 模式時，不需額外的電流控制電路，天生就具備高功因性能，而且儲能電容沒有高電壓應力的問題；配合電壓回授控制，使得此單級高功因電力轉換器兼具功因校正、電氣隔離與輸出穩壓等弁鄔 b 穩態分析方面，使用狀態空間平均法、無損失電阻(LFR)模型之諧波平衡法與無損失電阻模型之半線電壓週期模型法等三種方法，分析電力轉換器輸出電壓之直流值、漣波大小及相位角偏移量。然後利用 IsSpice 模擬電路，以驗證理論分析的正確性。

在輸出穩壓方面，以雙時間尺度平均化法與電流注入等效電路法推導單級高功因電力轉換器之小信號數學模式，得到一致的結果，並且利用 Agilent 35670A 動態信號分析儀量測轉移函數，其量測結果與理論推導結果相當吻合。最後使用古典控制理論設計穩壓控制器，以排除輸入電壓或負載變動對輸出電壓的影響，達到輸出穩壓目的。

在實作成果方面，研製了一組輸入電壓 110V ，輸出電壓 48V 功率的單級高功因電力轉換器，從實測結果驗證了高功因、低儲能電容電壓及輸出穩壓等性能。

英文摘要

A single-stage high power-factor converter combined by the buck-boost and flyback converters is studied in this thesis. The combined process of the converter is presented. The converter exhibits high power-factor inherently without external current control when it operates under DCM+DCM mode. Moreover, the high voltage stress of the bulk capacitor does not exist.

Based on the loss-free-resistor (LFR) model, the state-space averaging method, harmonics balance method and TL-model method are used to obtain the dc values, voltage ripples and phase angle shift for the bulk capacitor and output voltage in the steady-state analysis.The results of IsSpice simulation are used to verify theoretical analysis.

The two-time scale averaging method and current injected equivalent circuit approach are used to derived the small signal model and obtain the coincide results. The theoretical results are verified by the experimental measurements of dynamic signal analyzer (Agilent 35670A).Eventually, a controller is designed to eliminate the effect of the variations of line voltage and load on the output voltage.

A prototype of the converter with input voltage 110 Vrms, output voltage 48 V and maximal power 100 W is implemented. The performances of high power-factor, low bulk capacitor voltage stress and well output voltage regulation are verified by experimental measurements.