中文摘要

由於溫室效應之影響以及有限蘊藏石油量之快速消耗，各國政府均實施許多相關節能措施，以減少對環境之衝擊並提升產業競爭力。固未來使用石油之引擎將會減少而交流馬達的運用將會愈來愈重要，所以如何有效的設計控制器是很重要的。而目前在冷凍空調與節能方面均用到許多感應馬達以驅動壓縮機、泵浦、冰箱、風扇等。本論文之研究動機即在針對此類較不需要精確性能之節能應用，嚐試將目前已成熟之感應伺服控制技術予以簡化以作為冷凍與空調之節能應用。

本論文之主要貢獻基本上可分為四點。第一點，提出一感應馬達新型轉子磁場導向控制法則，可以節省兩個電流感測器及兩個電壓感測器，所以可以降低成本，且在其功能上，仍可達到傳統的轉子磁場導向控制之瞬時轉矩響應之效果，而控制策略中只利用一個 PI 控制器，大大解決了如何決定 Kp 及 Ki 的難題，固此控制策略具有設計簡單，易於實現之優點。第二點為針對此控制架構於冷凍空調節能方面不需要很準確的轉速控制之應用，提出一種新的轉速估測方法，可以免除安裝昂貴的轉速感測器。第三點，提出一新型感應馬達參數估測方法，可以有效消除感應馬達因外在環境變化對控制器性能所造成之負面影響。第四點為利用德州儀器公司新上市之 DSPTMS320F2812 高速數位訊號處理器，以完成一全數位化控制器，可大大減少所使用之類比電路元件數目，以提高系統設計之彈性及可靠度，使整體控制電路更為精簡。

Abstract

Due to the influence of greenhouse effects and the fast consumption of limited petroleum, the goverment of each nation has implemented different energy conservation policies to reduce the impact to the environment as well as enhance its national competitive power. Presently, lots of induction motors have been applied to drive various compressors、 pumps、 refrigerators and fans in refrigeration and air conditioning systems. In fact, it is the major motivation of this research to try to simplify the existing mature induction servo motor control technique and apply to the refrigeration and air conditioning systems where accurate control performance reguirement is not very critical.

Basically, the major contributions of this thesis may be summarized as follows. First, a novel rotor flux oriented control strategy for induction motors is proposed to obviate the use of two current sensors as well as two voltage sensors. As a result, the cost can be reduced without scarifying the dynamical performance of the conventional rotor flux oriented control. Second, a new speed estimator is proposed for estimating the motor speed to obviate the use of an expensive encoder. Third, in view of the negative impact due to detuning effect of parameter variations, a new on-line parameter identification method is proposed to update the parameters of the controller. Finally, a fully digital controller is implemented based on the proposed theoretional basis for the induction motor drive, by using a high speed digital signal processor, namely DSPTMS320F2812. Naturally, not only the number of hardware components can be reduced but also the system reliability and flexibility are enhanced.