結合尖端機電技術與資訊智慧之開放式控制器-子計畫二
伺服馬達控制之電力電子單晶片化電路設計(2/3)
The Single Chip Design and Implementation of the Power Electronics of a Motor Servo System

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中文摘要

本報告馬達驅動器採用針對交流馬達發展的磁場導向閉迴路控制系統架構，控制器的輸出是以空間向量脈寬調變法產生一組大小可控制的旋轉磁場，再加上電流迴路控制器以控制馬達的扭力。而在速度控制則是以馬達的解耦模型分析設計 PI 控制器，基於暫態及穩態中對於 PI 控制器增益值大小要求的不同，在此則設計增益預定 PI 控制器，以同時提高動態性能與減少穩態誤差，報告中並加有弱磁控制使馬達能超越額定轉速，擴大轉速範圍。最後以模擬及實作驗證其可行性，實作上採用 TI 生產的 TMS320F240 DSP 單晶片和龍慶公司的驅動器及永磁式同步馬達，整個系統控制都在此 DSP 晶片內完成。另外我們也發展主動式的功率因數修正器，這是一昇壓型的功因修正電壓源，實驗結果證明昇壓—電壓輸出的功率因數在我們測試的功率範圍內是趨進於 1。

英文摘要

In this project, we adopt field-oriented closed loop control for the system using an PMSM (Permanent Magnet Synchronous Motor). A current control in a synchronous rotating frame was designed in our control system for decreasing the steady state error of the AC motor driven system. Our controller can produce a rotating field-vector with the size controlled by a PWM generator. Using this way we can control the torque of motor. To obtain higher performance of the speed control, we propose a design criterion for designing PI control. Furthermore, we employ a so-called gain-scheduled PI controller to improve the step response and steady state error. A flux-weaken function with PI control is also designed in this project. By employing this control we can arise the motor speed to twice of the rated one. All our designs are implemented in using TMS320F240 DSP chip. In addition, we also designed a power factor adjustor which can boost the line voltage level to a higher dc voltage output. Our experimental results have shown that the power factor can be kept in almost one during our measure range from 225W to 500W.