

## 摘 要

線型永磁馬達由於本身架構簡單且具有直接驅動、安靜以及高可靠度等特性，近年來已逐漸地應用於工業上各種高精密度的快速定位以改善產量。然而，由於線型永磁馬達性能易受溫度、磁飽和以及負載等環境干擾而影響導致操作性能劣化，失去原先定位控制的優良特性，是故文獻上有提出使用具強健性之可變結構滑模控制以克服此困境，但是傳統可變結構滑模控制具有切跳效應之缺點，因此本論文的主要研究目標即在於運用一簡易定結構滑模控制以設計線型永磁馬達驅動器之強健性定位控制器，避免線型永磁馬達驅動器受參數與負載變動之影響。

基本上本論文主要的貢獻有以下三點：第一點，針對線型永磁馬達之位置控制設計其滑模定位控制器，不需改變控制器的結構仍可以達到可變結構滑模控制之強健效果，同時消除了傳統可變結構控制之切跳現象。其另外的特點為具有設計簡單、易於實現等優點。第二點，針對所設計之定結構滑模定位控制器輸入項中有一無法掌握之負載推力項，再進一步設計一負載推力估測器，以估測此負載推力項，並將其前饋至定結構滑模定位控制器，以獲得更佳之動態響應。第三點則為利用德州儀器公司新上市之TMS320F2812快速數位訊號處理器完成壹全數位化驅動器，以減少硬體電路之元件數目，增加可靠度，同時方便於維護及修改控制法則。最後並經由該離型之實驗結果，證實本論文所提之定結構滑模定位控制器確實能達到預期之效果。

## Abstract

Linear permanent magnet synchronous motors (LPMSM), due to their merits of simple structure, direct drive capability, less noisy and higher reliability, have now been widely applied in various industrial areas for fast and accurate position controls to increase the process output. However, the dynamic performance of a LPMSM is easily affected by the temperature change, magnetic saturation as well as the load disturbances. Hence, robust control such as variable structure sliding mode controls (VSSMC) were proposed in literature to overcome this dilemma. In view of these, the major motivation of this research lies in adapting a simple fixed structure sliding mode control (FSSMC) to design a robust position controller for LPMSM drives.

Basically, the major contributions of this thesis may be summarized as follows. First, a fixed structure sliding mode controller is proposed for LPMSM drives to achieve the same robust characteristic as that of a conventional VSSMC but without chattering phenomenon. Besides, due to the available closed form solution of the closed system eigenvalues, design and implementation of the proposed controller become very simple and straightforward. Second, in order to further improve the dynamic performance, a load disturbance estimator is also proposed and added to the proposed sliding mode position controller. Finally, a prototype is also constructed by using a high speed digital signal processor, namely TMS320F2812 to simplify the hardware structure. Experimental results show that the proposed fixed structure sliding mode controller can indeed achieve the desired performance.