xyz-三軸精密微動定位系統設計與制動機制

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摘 要

中 文 摘 要 精密定位技術是製造產品、測量物體尺寸、運轉各種機器之機械工程上的重要技術之一。隨著精密工程的不斷進步，不論是半導體產業、精密機械工業、生物細胞領域、光電系統、顯微機構、表面工程、STM、SPM等方面，皆朝微小化、精密化的方向前進，因此對於微米或次微米級的定位系統需求量日增。另一方面，具有機電轉換力的壓電材料（Piezoelectric Material），以其質輕、體積小、反應快、解析度高等特性已逐漸被注意，但由於遲滯現象（Hysteresis）及輸出位移的限制，其應用大部分侷限在感測器（Sensors）上只有少部分使用於致動器（Actuators）方面，但近年來由於壓電材料在材料性質的改進和積層式壓電陶瓷的開發，使得壓電材料能在低輸入電壓的驅動下有較高的位移輸出，更適於致動器的用途。 本文的研究目的為利用壓電材料作為致動器設計一用於掃描式穿隧顯微鏡上的精密定位平台，對於其壓電致動器做一探討研究，配合其壓電致動器之特性，設計一開迴路控制系統。 本文在設計上將設計一單自由度進給裝置與三自由度微動裝置，利用雙裝置整合方式來達成精密微動定位的目標，單自由度進給裝置主要是採用驅動位移量較大的壓電材料尺蠖蟲式（Inchworm）驅動設計，其解析度為＜40 nm；三自由度微動裝置是利用管狀的壓電材料作為驅動源。本文利用光槓桿法與光干涉法-麥克遜干涉儀來從事壓電致動器的位移量測和特性探討。

關鍵詞 : 壓電材料 ; 遲滯現象 ; 掃描式穿隧顯微鏡 ; 單自由度進給裝置 ; 三自由度微動裝置

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