傳動系統之主動式振動控制

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摘 要

本論文主要是描述利用數位信號處理器來實現傳動系統之主動式振動控制器，期能消除傳動系統所產生之週期與非週期性振動。因近年來操作環境舒適性愈來愈受到重視，加上在機械系統中，因為齒輪在囓合時的衝擊和軸心不對稱時所產生的振動對於在運轉中的機械會造成傷害，通常為了解決這些問題大多都是使用被動式的方法，而傳統的被動式隔振系統，雖然設計簡單，安裝容易且具有系統較穩定的優點，但被動式控制系統的設計參數經常是固定的，並不能隨著操作環境的不同而改變；同時被動式隔振系統，對於高頻的振動控制效果較佳，相對地對於低頻振動控制效果較差且適應性又不良，以致於隔振效果被限制在某些頻率下。因此在利用主動式的方法來改善。所以在本研究將發展針對傳動系統所產生之窄頻或週期性等較穩定振動源之控制系統，利用前饋、回饋及混合型等三種基本控制架構並利用有限脈衝響應濾波器來實現控制器。 在前饋控制中應用適應性濾波器及最小均方根誤差理論，回饋控制採用的是線性二次型高斯法的現代控制理論和後現代控制理論所發展的強健控制 和 分析理論。在混合型的控制架構中是結合前饋式性能佳的優點和回饋式快速收斂及強健性較佳的優點。在實際傳動系統上，外在條件的影響因素相當多，如轉速變化及外在振動傳遞等，這些因素勢必需納入控制器設計時參考之要素。一般傳統控制理論是以單輸入單輸出系統控制的效果較佳；但以傳動系統的觀點而言，則是一典型的多輸入多輸出系統，因此要以現代控制理論的架構為基礎，才能符合系統複雜度的需求。 本論文將比較其七種控制方法實現於模擬傳動隔振平台之實驗結果。前饋之控制性能佳，但缺乏強健性，而回饋控制結果顯示恰與前饋相反；因此，在本論文之後半部衍生出混合式控制，其控制效果顯示性能及強健性都比前饋及回饋來得佳，模擬傳動平台之控制器實現及比較將在本論文裡予以探討。

關鍵詞 : 傳動平台系統，主動式振動控制，數位信號處理

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