多通道之主動式引擎隔振控制系統

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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汽車引擎多點懸吊系統之主動式振動控制器，期能消除 汽車引擎系統所產生之週期與非週期性振動。而本研究中是以單自由度及多自由度懸吊振動平台藉以模 擬引擎懸吊隔振控制系統之架構。因近年來汽車乘坐舒適性愈來愈受到重視，而傳統被動式隔振系統， 雖然設計簡單，安裝容易且系統較穩定，但被動式控制的設計參數經常是固定的，並不能隨引擎操作環 境不同而改變；同時被動式隔振系統，對於高頻域控制效果較佳，相對地在低頻域控制效果較差。所以 在本研究將發展針對窄頻或週期性等較穩定振動源之控制系統，利用前饋、回饋及由前饋與回饋所衍生 的複合型等三種控制基本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的現代控 制理論及後現代控制論所發展的強健控制 理論。在複合型的控制架構中是結合前饋式性能佳的優點及回 饋式的收斂快速及強健功能，而達到性能及穩定強健性較佳之優點。在實際引擎懸吊系統上，外在條件 的的影響因素相當多，如引擎轉速變化及汽車底盤振動傳遞等，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；但以引擎多點懸吊系統的觀點而言 ，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 。 本論文將評估其三種控制器及三種控制架構實現於兩個模擬引擎懸吊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複合式 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，兩個模擬引擎懸吊平台之控制器實現及差 異將在本論文裡予以探討。

關鍵詞 : 引擎懸吊平台系統，主動式振動控制，數位信號處理

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