主動式與半主動式之振動控制應用於車輛駕駛座椅系統

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摘 要

本論文主要描述利用主動式振動控制(AVC)技術及半主動式振動控制(SAVC)技術來改善車輛駕駛座椅之振動問題，以提高車輛行駛時之乘坐舒適性。第一部份主要描述應用主動式控制技術來實現汽車駕駛座椅之振動控制。此研究中以多自由度平台模型來模擬車輛駕駛座椅系統架構。實驗中分別提出適應性控制器、H∞回饋控制器及混合強健控制器之控制架構。此三種控制器皆於頻域上所考量設計，以有限脈衝響應濾波器(FIR)做為現實，並利用數位訊號處理器來做即時控制。實驗中即針對低頻之週期性及隨機振動源做主動控制之試驗，而三種控制器之性能與特性也將於本論文中一併做探討與分析。第二部份則是描述以智慧型材料之電流變液(ER Fluids)做為致動器元件，提出新的半主動式控制技術來實現單自由度系統之隔振控制。由於電黏性液體在工業上之應用非常廣泛，其材料性質為反應速度快、具可逆性及可連續控制阻尼力之操作範圍大等特性。因此，於研究中將應用獨特之電流變效應，以提出新的電場控制技術來針對寬頻及週期性激振源做最佳化控制。最佳化控制器之設計主要是以H2控制概念來降低系統轉移函數大小之總頻譜能量，而on/off控制策略主要以頻率計數之概念來隔絕外擾發生時所造成的共振現象。研究中先以單自由度振動系統模型來做理論分析，了解其系統在頻域上之響應特性，並以此做為控制器設計之參數。實驗驗證方面，設計擠壓模式之電流變液減振器，由實驗中量測其在各種參數影響下之特性關係，架設單自由度振動平台以實現控制器之性能。在實驗與模擬結果相互驗證下，證實所提出之控制概念將有效抑制不同之振動源。

關鍵詞 : 主動式振動控制、半主動式振動控制、車輛駕駛座椅、數位信號處理器、電流變液

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