MFC壓電致動器應用瑜蜂巢三明治平版的噪音控制 = Active noise control of honeycomb sandwich panels using MFC actuators

吳鎧麟、羅正忠

E-mail: 9707383@mail.dyu.edu.tw

摘 要

對於有效增加噪音損失方面已有許多研究已完成或還在實驗中，控制方法有包含許多種，主要分類還是注重在主動式控制、被動式控制和混合式控制。但是如何將控制效果達到最佳化，如何同時控制低頻和高頻噪音穿透損失值達到最好的效果，如何找出平板振動對於噪音增減之影響。以上問題都是從是噪音控制和結構振動的學者所注重的領域。 本論文的目的是使用MFC壓電致動器作為振動控制元件，結合主動式控制與被動式壓電分流器兩種方法，並且用理論分析與實驗得知MFC主動與被動的控制效率。執行項目包括：⑴將黏貼於蜂巢三明治平板上的MFC壓電致動器當作致動器，並以掃頻方式去驗證不同組合對於振動模式的激振敏感性，有助於未來的控制設計；⑵完成蜂巢三明治平板複材結構對於主動式單模態速度回饋控制實驗分析；⑶透過主動式單模態速度回饋控制來達到輻射噪音控制實驗分析；⑷利用MFC壓電致動器配合電阻式分流器電路，得知使用MFC壓電致動器來抑制穿透噪音的效能。

關鍵詞 : 噪音穿透損失;速度回饋控制;輻射噪音;電阻式分流器

目錄

參考文獻

[1] 劉孝偉，“複合三明治平板黏彈性分析”，國立中正大學碩士論文，指導教授:黃崧任 [2] www.smart-materials.com [3] P. Lueg, “Process of silencing sound oscillations,” U. S. Patent 2043416, 1936.

[4] M. A. Swinbanks, “The active control of sound propagation in long ducts,” Journal of Sound Vibration, p.411~436, 1973.

[5] J. C. Burgess, “Active Adaptive Sound Control In a duct:A Computer Simulation,” J. Acoustic. Soc. Am, 1981.

[6] J. A. Steel, “Sound transmission between plates in framed structure,” Journal of Sound and Vibration, pp.379~394, 1994.

[7] Gopal P. Mathur and Boi N. Tran, “Active Structural Acoustic Control of Sound Transmission Through a Panel with Vibration and Acoustic Sensors,” Recent Advances in Active Control of Sound and Vibration, pp.369~3793, 1993.

[8] K. Renji “Sound transmission loss of unbounded panels in bending vibration considering transverse shear deformation,” Journal of Sound and Vibration, pp.478~486, 2005.

[9] Huei Jeng Lin, Chao Nan Wang and Yan-Min Kuo “Sound transmission loss across specially orthotropic laminates,” Applied Acoustics, pp.1177~1191, 2006.

[10] B. H. Sharp, “Prediction methods for the sound transmission of building elements,” Noise Control Engineering, pp.53~63, 1978.

[11] W. Desmet and P. Sas, “Sound transmission of finite double-panel partitions with sound absorbing material and panel stiffeners,” CEAS/AIAA Joint Aeroacoustics Conference, pp.311~320, 1995.

[12] 林輝政、王昭男、郭彥閔，“非等向性FRP材料聲學性質及隔音效能之研究”，國立成功大學論文，1996.

[13] D. Millar, “The Behavior of Light Weight Honeycomb Sandwich Panels Under Acoustic Load,” Proceedings of the sixth International Conference on Recent Advances in Structure Dynamics, pp.995~1006, 1997.

[14] Wen Chao Huang and Chung Fai Ng “Sound insulation improvement using honeycomb sandwich panel,” Applied Acoustics, pp.163~177, 1998.

[15] Portia R. Peters, Shankar Rajaram and Steven Nutt “Sound transmission loss of damped honeycomb sandwich panels,” 2006.

[16] P. Thamburaj and J. Q. Sun“ Optimization of anisotropic sandwich beams for higher sound transmission loss, ” Journal of Sound and Vibration, pp.13~30, 2002.
[17] P. De Man, A. Francois and A. Preumont“ Active control of noise transmission through double wall structures An overview of possible approaches, ” 6th National Congress on Theoretical Applied Mechanics, 2003.
[18] P. Sas, C. Bao, F. Augusztinovicz and W. Desmet,“ Active Control of Sound Transmission Through A Double Panel Partition, ” Journal of Sound and Vibration, pp.609~625, 1995.
[19] Kuo Tsai Chen,“ An Adaptive Active Control of Sound Transmission through an Aperture at Low Frequencies, ” Applied Acoustics, pp.153~174, 1995.
[20] K. Henrioulle, W. Dehandschutter and P. Sas, 1998,“ Active control of sound transmission through a single panel partition. Part I : Simulations, ” Proc. ISMA23 Noise and Vibration Eng., pp.16~18, 1998.
[21] C. C. Sung and Chiu,“ Control of Sound Transmission through Thin Plate, ” Journal of Sound and Vibration, pp.605~618, 1998.
[22] 潘政佳“ 穿透平板噪音之主動結構噪音控制 ” 國立成功大學造船暨船舶機械工程研究所碩士論文，2001.
[23] R. L. Forward,“ Electronic Damping of Vibration in Optical Structures ”, Journal of Applied Optics, 18(5), pp. 690-697, 1979.
[24] Hagood and A. Von Flotow,“ Damping of Structural Vibrations with Piezoelectric Materials and Passive Electrical Network ”, Journal of Sound and Vibration, 249(2), pp. 227-250, 2002.
[25] J-K. Lee, J. Kim, C-J. Rhee, C-H. Jo and S-B. Choi,“ Noise Reduction of Passive and Active Hybrid Panels, ” Smart Materials and Structures, 11(6), pp. 940-946, 2002.
[26] 魏騰佑“ 自行車壓電纖維複材把手管件的振動控制使用有限元素模型法 ” 大葉大學機械工程研究所碩士論文，2005.