

Application of H-infinity Hybrid Active Controller for Acoustic Duct Noise Cancellation

Wu, Jian-Da; Lee, Tian-Hua

Abstract

This paper describes the principle and application of a hybrid robust active noise controller (ANC) for reducing broadband noise in acoustic ducts. The proposed ANC system consists of an adaptive controller with filtered-x least mean square (FXLMS) algorithm and a feedback structure with robust synthesis theory for obtaining robust performance and stabilisation. In an active control structure, plant uncertainty is one of the major factors that may affect the performance as well as stability of a system and must be taken into account in controller design. In this study, the controller is designed by frequency domain method and implemented on a digital signal processor (DSP) platform for real time control. Experiments are carried out to evaluate the attenuation performance of the proposed control system for synthetic random noise in an acoustic duct. The experimental results indicate that the proposed hybrid controller is effective in suppressing the undesired broadband noise. Furthermore, characteristic analysis and experimental comparison of adaptive feedforward structure, pure feedback control structure and proposed hybrid structure for reducing the noise in a duct are also presented in this paper.

Key words : Active noise control; Hybrid controller; Acoustic ducts; Broadband noise; Real time control; Frequency domain; Digital signal processor; DSP; Noise reduction; Engine exhaust noise; Vehicle noise