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Analysis and DSP Implementation of a Broadband Duct ANC System Using Spatially Feedforward Structure

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Abstract

The active control technique for broadband attenuation of noise in ducts, using spatially feedforward structure, is investigated from the viewpoints of both acoustic analysis and control engineering. According to the previous work by Munjal and Eriksson [1], there exists an ideal controller for this problem. The ideal controller is a function of the finite source impedance and is thus independent of the boundary conditions. Despite the simplicity, the ideal controller cannot be practically implemented due to the difficulty of calibration of electro-mechanical parameters. To overcome the problem, the controller is implemented via an equivalent formulation modified from the controller originally proposed by Roure [2]. The modified controller is implemented on a DSP platform, using a FIR filter, an IIR filter and a hybrid filter. The experimental results showed that the system achieved 17.2 dB maximal attenuation in the frequency band 300~600 Hz. Physical insights and design considerations in implementation phase are also discussed in the paper.