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An efficient iterative scheme to compute an FIR filter

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1 Introduction

Acoustic anechoic chambers are designed to absorb acoustic waves at its boundaries. In practice, low-frequency sound will be reflected at the walls due to limitations of the passive absorption measures. Active noise control is effective at lower frequencies, which makes this a promising addition to the passive wall absorption. Typical chamber dimensions are large, requiring a larger number of sources and sensors for satisfactory performance. The computational complexity increases rapidly for growing system sizes. This work proposes an efficient scheme to compute a finite impulse response controller, demonstrated by a multichannel example.

2 Approach

The proposed scheme is based on the work presented in [1], but substituted with the frequency-domain derived filters from [2], to reduce computational complexity. This results in the scheme as shown in Fig. 1.

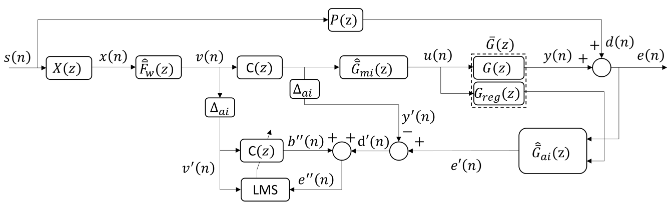

Figure 1: Block-scheme of the proposed algorithm [3].

The filter $\hat{\tilde{F}}_w(z)$ is the prewhitening filter that applies prewhitening and decorrelation. The filter $\hat{\tilde{G}}_{mi}(z)$ is the preconditioning filter, and the filter $\hat{\tilde{G}}_{ai}(z)$ is the adjoint, which together decouple the system. These filters need an appropriate number of delay samples in order to ensure causality.

3 Simulation

The performance of the algorithm is shown using a 4-channel setup. The objective of the system is to reduce the reflections from the walls of the chamber, with the idea of improving an acoustic anechoic chamber. The decoupling of the plant for the first two channels is shown in Fig. 2. It can be seen that the plant is effectively diagonalized.

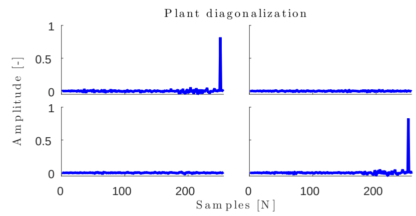

Figure 2: Decoupling of the plant using the filters $\hat{\tilde{G}}_{mi}(z)$ and $\hat{\tilde{G}}_{ai}(z)$.

The convergence of the algorithm is shown for the first two channels in Fig 3, where the controller converged to 13 dB reduction on the first channel and 14 dB on the second channel.

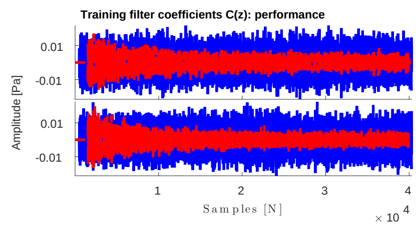

Figure 3: Convergence of the controller performance while running the proposed scheme.

4 Acknowledgements

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References

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