Treatment of Enhancement Problem in Active Noise Control

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Project Description

- In an MIMO Active Noise Control (ANC) system, correlated reference signals may result in noise enhancement.
- For example, the reference signals in a waveguide can be correlated at low frequencies since all noise sources are propagating as plane waves in the duct.
- A method was developed so that noise reduction can be achieved without enhancement.

Approach

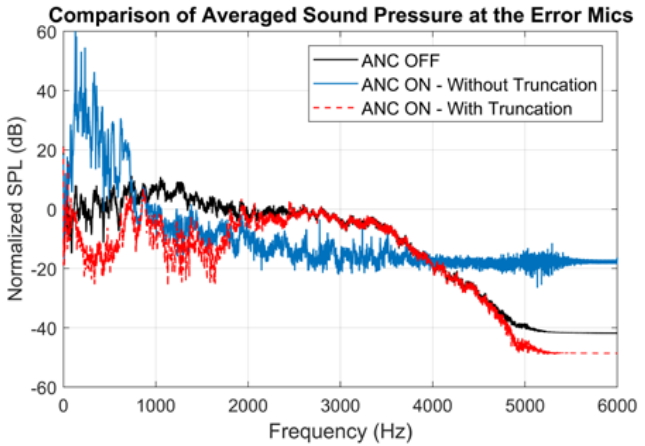
- Based on analysis, it was found that the noise enhancement phenomenon is due to the small singular values in the covariance matrix of the filtered reference signals.
- Enhancement can be mitigated by applying Truncated Singular Value Decomposition (T-SVD) to the covariance matrix to remove the small singular values.
- Then calculate the coefficients of the ANC filter using the covariance matrix after T-SVD.
- Verify the effect of enhancement mitigation in simulation and experiments.

Discussion

- Noise enhancement may occur in ANC when reference signals are correlated.
- Enhancement is resulted from the small singular vales of the covariance matrix.
- Enhancement can be mitigated by removing the small singular values.
- The mitigation of enhancement may reduce the noise reduction performance in some frequency band.

Results

- Applying T-SVD method, the noise enhancement in 0~900 Hz and above 4000 Hz are mitigated.
- In the meantime, the noise cancellation performance is sacrificed between 2000 ~ 4000 Hz.



A method was developed to mitigate the noise enhancement in Active Noise Control Systems due correlated reference signals.