INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Retrospective Cost Adaptive Control for Feedforward Active Noise and Vibration Control

TECHNOLOGY NUMBER: 7132

OVERVIEW

Adaptive feedforward control for disturbance rejection with minimal prior modeling

- Requires less prior information about disturbances and system models
- Applicable to aerospace, automotive, consumer electronics, building sectors

BACKGROUND

Active noise and vibration control aim to eliminate undesirable sounds or motions by generating counteracting sound waves or vibrations. This technology features in noise-canceling headphones, automobile cabin acoustics, commercial building air ducts, and skyscraper vibration mitigation. Traditional methods to tackle disturbance rejection include feedback and feedforward techniques, often relying heavily on precise modeling of both the disturbance and the system. These models generally need to predict the behavior of narrowband, wideband, and non-periodic disturbances accurately. However, challenges arise when minimal information about the disturbances and the system model is available beforehand, limiting the effectiveness and adaptability of conventional approaches. Therefore a need exists for a more versatile method that can adapt to various types of disturbances without extensive pre-modeling work.

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Category
Software
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INNOVATION

Researchers have developed a technology that introduces an adaptive feedforward control algorithm designed to reject disturbances with minimal prior information about the system and disturbances. Unlike traditional methods that rely on detailed models, this adaptive algorithm can effectively manage narrowband, wideband, and non-periodic disturbances. It eliminates the need for extensive pre-modeling, offering a significant advantage over existing commercial feedforward control methods. This approach also provides an alternative to architectures requiring feedback neutralization. Simulation data confirms the algorithm's effectiveness, showcasing its potential to revolutionize active noise and vibration control. Real-world applications span across aerospace for mitigating aircraft vibrations, automotive for enhancing in-cabin acoustics, consumer electronics like next-generation noise-cancelling headphones, and the building sector for counteracting wind-induced vibrations in tall structures.