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Time-domain estimation of acoustic radiation modes and active structural acoustic control (Conference Paper)

Nor, K.A.M.^{a,b}, Mace, B.R.^a, Hioka, Y.^a

^aDepartment of Mechanical Engineering, University of Auckland, Auckland, 1142, New Zealand

^bDepartment of Mechatronics Engineering, International Islamic University Malaysia, Kuala Lumpur, 53100, Malaysia

Abstract

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This paper presents a method of calculating the radiated sound power of vibrating structures based on the time domain estimation of acoustic radiation modes (ARMs). Each ARM is frequency-dependent, radiates power independent of the other ARMs and can be estimated in the time domain from measurements made at discrete sensor locations on the surface of the radiating structure. The individual ARM components are estimated digitally in the time domain using finite impulse response filters, which are designed to provide a best weighted fit to the ARMs in the frequency domain. The ARM amplitudes are estimated by filtering the vectors of measured velocities at points on the radiating surface with these ARM filters, before summing the product of the square of these amplitudes with the relevant eigenvalues to estimate the radiated sound power. The method is described with reference to a simply supported beam model. The results show that the sound power calculated from the proposed approach and from a frequency domain approach are comparable. Finally, a time domain feedforward active structural acoustic control system developed using the proposed method is presented and time domain simulations demonstrate the performance of the system.

SciVal Topic Prominence ⓘ

Topic: Architectural acoustics | Acoustic wave transmission | Acoustic control

Prominence percentile: 85.442 ⓘ

Indexed keywords

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- Acoustic emissions
- Acoustic radiators
- Acoustic wave propagation
- Acoustic wave transmission
- Acoustic waves
- Architectural acoustics
- Eigenvalues and eigenfunctions
- Frequency domain analysis
- Impulse response

Engineering uncontrolled terms

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- Active structural acoustic control
- Frequency dependent
- Frequency domain approaches
- Radiated sound power
- Simply supported beam model
- Time-domain simulations
- Vibrating structures

Engineering main heading:

- Time domain analysis

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