Estimation of Frequency-averaged Loss Factors by the Power Injection and the Impulse Response Decay Methods

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Abstract

This paper describes a comparison, both analytically and experimentally, between two widely used loss factor estimation techniques frequently used in statistical energy analysis. Analytical models of simple spring/mass/damper systems were created to compare frequency-averaged loss factor values from the single subsystem power injection method and the impulse response decay method. The parameters of the analytical models were varied to study the effects of the total number of modes, amount of damping, location of modes within frequency bands, and the width of the frequency bands on loss factor estimation. The analytical study shows that both methods give accurate loss factor values as long as the damping values remain realistic for linear systems and at least one modal resonance is present in each frequency band. These analytical results were verified experimentally by measuring the loss factors of simple steel plates, with and without damping treatments applied.

Keywords: architectural acoustics, damping, vibrations, transient response