



REVIEWER'S REPORT

Manuscript No.: IJAR-56454

Title: Uncertainty-Aware Vibration Control in Laminated Composite Structures: A Comprehensive Review

Recommendation:

Accept

Rating	Excel.	Good	Fair	Poor
Originality	Yes			
Techn. Quality		Yes		
Clarity	Yes			
Significance		Yes		

Reviewer Name: Dr. Ashish Yadav

Detailed Reviewer's Report

Reviewer's Comment for Publication.

Acceptance Comment are mentioned below suitable for the paper titled "Uncertainty-Aware Vibration Control in Laminated Composite Structures: A Comprehensive Review"

Reviewer Comments: Accept

Reviewer Comments –

Introduction

The introduction effectively establishes the significance of laminated composite structures in high-performance engineering domains such as aerospace and civil infrastructure. The authors clearly articulate the challenges posed by material uncertainties, manufacturing imperfections, and in-service damage on vibration characteristics. The motivation for integrating uncertainty modeling with vibration control strategies is well justified, and the research scope is clearly delineated. The problem statement is concise and aligns well with current research trends in smart and adaptive structural systems. The introduction successfully positions the review within the broader context of structural dynamics and control literature.

Literature Review

The literature review is thorough and systematically organized. The discussion of modeling frameworks, including Classical Laminate Theory (CLT), First-Order Shear Deformation Theory (FSDT), and Higher-Order Shear Deformation Theories (HSDT), demonstrates a strong theoretical foundation. The categorization of vibration control approaches into active, passive, and hybrid methods is clear and insightful. The review critically compares control techniques such as piezoelectric-based active control, viscoelastic damping, tuned mass dampers, and adaptive hybrid systems. Importantly, the manuscript integrates contemporary studies addressing uncertainty quantification methods (e.g., stochastic modeling, probabilistic approaches, and interval analysis), which significantly enhances the scholarly depth of the review. The synthesis reflects a balanced and critical understanding rather than a descriptive summary.

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Methodology

Although the manuscript is a review article, the methodological framework adopted for synthesizing prior studies is systematic and well-articulated. The authors classify existing works based on modeling theory, control strategy, uncertainty treatment, and application domain (aerospace, naval, civil structures such as bridges). The derivation and presentation of governing equations using Hamilton's principle and Euler-Lagrange formulations provide clarity and theoretical continuity across reviewed studies. The structured comparison of damping estimation techniques, stabilization strategies, and modal characterization methods under uncertainty demonstrates methodological rigor. The review methodology ensures logical flow and coherence, making it highly accessible to researchers and practitioners.

Results and Discussion

The results and discussion section provides a meaningful synthesis of findings from contemporary studies rather than merely reporting them. The comparative analysis of control performance under damage scenarios and material variability is particularly commendable. The discussion effectively highlights how uncertainties influence modal frequencies, damping ratios, and system stability. The identification of performance trade-offs among active, passive, and hybrid systems under uncertain conditions adds practical relevance. Furthermore, the articulation of research gaps—such as the need for real-time uncertainty-adaptive control algorithms, integration of machine learning techniques, and experimental validation of stochastic control models—demonstrates forward-looking insight.

Conclusion and Future Scope

In conclusion, this review highlights that effective vibration control in laminated composite structures requires an integrated approach that combines accurate laminate modeling theories (CLT, FSDT, and HSDT), robust uncertainty quantification techniques, and advanced control strategies tailored to damage-sensitive environments. The synthesis demonstrates that material variability, geometric imperfections, and progressive damage significantly influence modal parameters, damping behavior, and system stability, thereby necessitating uncertainty-aware control frameworks. While passive methods provide inherent robustness and simplicity, active and hybrid control strategies offer superior adaptability and performance under uncertain and time-varying conditions. Future research should focus on developing real-time adaptive and self-sensing control systems, integrating probabilistic and data-driven approaches such as machine learning with physics-based models, enhancing experimental validation under realistic loading scenarios, and exploring multi-scale damage modeling for improved predictive accuracy. Such advancements will strengthen the reliability, resilience, and long-term performance of laminated composite structures across aerospace, naval, and civil engineering applications.