Helicopter Vibration Response Prediction and Measurement Comparison Under Rotor Excitation (Postprint)

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Abstract

Rotor excitation constitutes the primary source of helicopter vibration, influencing pilot controllability, occupant comfort, and structural fatigue life. Vibration issues typically manifest during flight testing, and their resolution often entails substantial time and cost, thereby impacting helicopter development. Helicopter vibration response prediction represents one of the principal approaches to addressing vibration problems, enabling early identification of such issues and facilitating optimization design or mitigation planning during the initial phases of model development. This study establishes a methodology for helicopter vibration response prediction under rotor excitation based on an airframe dynamics simulation model, which employs vibration loads at the rotor hub center in a fixed coordinate system as input to derive vibration responses at critical airframe locations. Comparative analysis between predicted and measured responses at critical locations under tail rotor excitation for a specific helicopter demonstrates that the speed-dependent variation of vibration responses obtained through this method aligns with measured data, with accuracy satisfying engineering requirements. This approach exhibits significant engineering value in applications including vibration response analysis for new aircraft, vibration problem diagnosis, and vibration control scheme development.

Full Text

Preamble

[The provided text is corrupted and cannot be meaningfully translated. The content consists primarily of PDF extraction artifacts, garbled character sequences, and unreadable fragments interspersed with mathematical placeholders. No coherent Chinese academic prose could be recovered from this section.]

Note: Figure translations are in progress. See original paper for figures.