Engineering Modeling and Flight Test Verification of Rotor Dynamic Loads Based on Distributed FBG Sensing Measurements: Postprint

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Abstract

To apply distributed fiber Bragg grating (FBG) sensing networks for flight measurement of helicopter rotor dynamic loads, a layout scheme for the FBG sensor network on blade surfaces was designed through comprehensive analysis of rotor blade loads and strain, as well as the operational requirements of FBG sensors. Based on this, engineering modeling methods and calibration test methods based on FBG strain measurement were proposed. The model was established through single-loading tests and validated through composite-loading tests. The validation analysis yielded a maximum load relative error of 3.83%, which is superior to the 5% engineering requirement for flight measurement. Comparative flight tests for helicopter rotor dynamic loads were completed using two different sensors, namely FBG sensors and strain gauges, with measurement results being mutually verifiable in both the time and frequency domains. The flight test results demonstrate that the FBG sensing network measurements are correct and effective, and that the engineering modeling method for rotor dynamic loads based on distributed FBG sensing measurement is reasonable and feasible.

Full Text

Preamble

The provided text is severely corrupted and contains no recoverable Chinese content for translation. The body consists primarily of binary artifacts, PDF extraction errors (e.g., `(cid:XXX)` sequences), and repetitive corrupted patterns (e.g., `fghi&IEEPO& TT@=87+^=E.+<?.+@/#jklmn&TUV&&W`), interspersed with mathematical placeholders.

Following the instruction to **skip garbage text** and **not translate nonsense**, while **preserving all MATH placeholders** exactly as given, the untranslatable corrupted portions have been omitted. Only the section heading and the

sequence of mathematical placeholders present in the original are retained below.

Mathematical placeholders recovered from the original document:

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