Post-Print: Static Aeroelastic Correction of Wing Loads for Large Aircraft Based on Flight Test Data

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Abstract

The structural elasticity of large aircraft significantly affects the magnitude and distribution of airframe loads, and accurate calculation of load variations induced by structural elasticity is of great significance for improving aircraft design standards. First, a static aeroelastic theoretical correction method for wing aerodynamic loads is presented. This method employs engineering beam theory to compute wing deformation, uses the vortex lattice method to calculate aerodynamic force increments caused by deformation, and then iterates until convergence. The lifting surface theory is used to improve and enhance the lifting line theory in the NACA-TN3030 report. The accuracy of this theoretical method is verified through wind tunnel tests. In flight tests, data on both wing deformation and flight parameters were measured, and elastic correction calculations were performed separately using each of these two types of data as input. The results obtained from the two approaches mutually validate each other, and the corrected results show good agreement. After load correction, the wing root bending moment is reduced by approximately 3%. This method is readily applicable in engineering practice and holds significant promise for reducing wing structural weight.

Full Text

Preamble

Translator's Note on Source Text Corruption

The remainder of this section in the original manuscript is extensively corrupted and cannot be reliably translated. This corruption compromises the entire substantive content beyond the section header, leaving the material unreadable or incomplete. Attempting to reconstruct or translate the corrupted portions

would require speculative interpretation beyond what is academically appropriate, potentially introducing inaccuracies that violate standards of translation fidelity. Therefore, to preserve the scholarly integrity and reliability of this document, the corrupted content is omitted from the translation. Readers seeking this information should refer to alternative sources or versions of the manuscript if available.

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