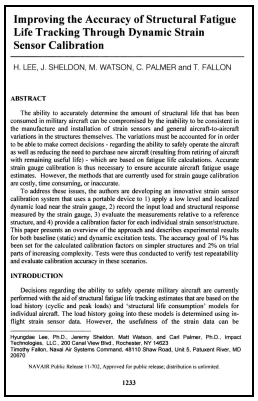

Improving the Accuracy of Structural Fatigue Life Tracking Through Dynamic Strain Sensor Calibration

H. LEE, J. SHELDON, M. WATSON, C. PALMER and T. FALLON

ABSTRACT

The ability to accurately determine the amount of structural life that has been consumed in military aircraft can be compromised by the inability to be consistent in the manufacture and installation of strain sensors and general aircraft-to-aircraft variations in the structures themselves. The variations must be accounted for in order to be able to make correct decisions - regarding the ability to safely operate the aircraft as well as reducing the need to purchase new aircraft (resulting from retiring of aircraft with remaining useful life) - which are based on fatigue life calculations. Accurate strain gauge calibration is thus necessary to ensure accurate aircraft fatigue usage estimates. However, the methods that are currently used for strain gauge calibration are costly, time consuming, or inaccurate.

To address these issues, the authors are developing an innovative strain sensor calibration system that uses a portable device to 1) apply a low level and localized dynamic load near the strain gauge, 2) record the input load and structural response measured by the strain gauge, 3) evaluate the measurements relative to a reference structure, and 4) provide a calibration factor for each individual strain sensor/structure. This paper presents an overview of the approach and describes experimental results for both baseline (static) and dynamic excitation tests. The accuracy goal of 1% has been set for the calculated calibration factors on simpler structures and 2% on trial parts of increasing complexity. Tests were thus conducted to verify test repeatability and evaluate calibration accuracy in these scenarios.

INTRODUCTION

Decisions regarding the ability to safely operate military aircraft are currently performed with the aid of structural fatigue life tracking estimates that are based on the load history (cyclic and peak loads) and 'structural life consumption' models for individual aircraft. The load history going into these models is determined using in-flight strain sensor data. However, the usefulness of the strain data can be

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NAVAIR Public Release 11-702. Approved for public release; distribution is unlimited.

1233

Код: 10389

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Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 3 единицы
ISBN: 978-1-60595-053-2

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Ключевые слова:

Содержание.