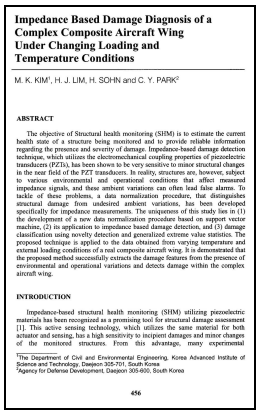

Impedance Based Damage Diagnosis of a Complex Composite Aircraft Wing Under Changing Loading and Temperature Conditions

M. K. KIM[1], H. J. LIM, H. SOHN and C. Y. PARK[2]

ABSTRACT

The objective of Structural health monitoring (SHM) is to estimate the current health state of a structure being monitored and to provide reliable information regarding the presence and severity of damage. Impedance-based damage detection technique, which utilizes the electromechanical coupling properties of piezoelectric transducers (PZTs), has been shown to be very sensitive to minor structural changes in the near field of the PZT transducers. In reality, structures are, however, subject to various environmental and operational conditions that affect measured impedance signals, and these ambient variations can often lead false alarms. To tackle of these problems, a data normalization procedure, that distinguishes structural damage from undesired ambient variations, has been developed specifically for impedance measurements. The uniqueness of this study lies in (1) the development of a new data normalization procedure based on support vector machine, (2) its application to impedance based damage detection, and (3) damage classification using novelty detection and generalized extreme value statistics. The proposed technique is applied to the data obtained from varying temperature and external loading conditions of a real composite aircraft wing. It is demonstrated that the proposed method successfully extracts the damage features from the presence of environmental and operational variations and detects damage within the complex aircraft wing.

INTRODUCTION

Impedance-based structural health monitoring (SHM) utilizing piezoelectric materials has been recognized as a promising tool for structural damage assessment [1]. This active sensing technology, which utilizes the same material for both actuator and sensing, has a high sensitivity to incipient damages and minor changes of the monitored structures. From this advantage, many experimental

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Ключевые слова:

Содержание.