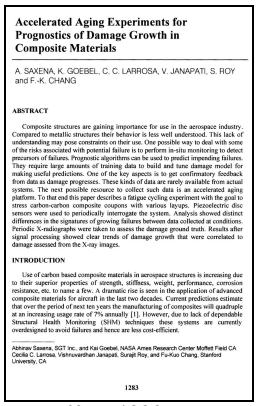
Accelerated Aging Experiments for Prognostics of Damage Growth in Composite Materials

A. SAXENA, K. GOEBEL, C. C. LARROSA, V. JANAPATI, S. ROY and F.-K. CHANG

ABSTRACT

Composite structures are gaining importance for use in the aerospace industry. Compared to metallic structures their behavior is less well understood. This lack of understanding may pose constraints on their use. One possible way to deal with some of the risks associated with potential failure is to perform in-situ monitoring to detect precursors of failures. Prognostic algorithms can be used to predict impending failures. They require large amounts of training data to build and tune damage model for making useful predictions. One of the key aspects is to get confirmatory feedback from data as damage progresses. These kinds of data are rarely available from actual systems. The next possible resource to collect such data is an accelerated aging platform. To that end this paper describes a fatigue cycling experiment with the goal to stress carbon-carbon composite coupons with various layups. Piezoelectric disc sensors were used to periodically interrogate the system. Analysis showed distinct differences in the signatures of growing failures between data collected at conditions. Periodic X-radiographs were taken to assess the damage ground truth. Results after signal processing showed clear trends of damage growth that were correlated to damage assessed from the X-ray images.

INTRODUCTION

Use of carbon based composite materials in aerospace structures is increasing due to their superior properties of strength, stiffness, weight, performance, corrosion resistance, etc. to name a few. A dramatic rise is seen in the application of advanced composite materials for aircraft in the last two decades. Current predictions estimate that over the period of next ten years the manufacturing of composites will quadruple at an increasing usage rate of 7% annually [1]. However, due to lack of dependable Structural Health Monitoring (SHM) techniques these systems are currently overdesigned to avoid failures and hence are less cost-efficient.

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**Ключевые слова:**

**Содержание.**