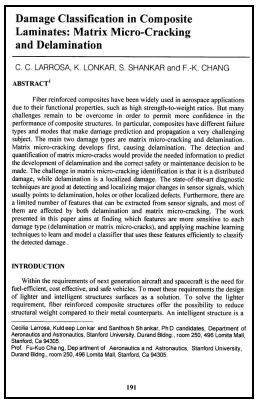

Damage Classification in Composite Laminates: Matrix Micro-Cracking and Delamination

C. C. LARROSA, K. LONKAR, S. SHANKAR and F.-K. CHANG

ABSTRACT[1]

Fiber reinforced composites have been widely used in aerospace applications due to their functional properties, such as high strength-to-weight ratios. But many challenges remain to be overcome in order to permit more confidence in the performance of composite structures. In particular, composites have different failure types and modes that make damage prediction and propagation a very challenging subject. The main two damage types are matrix micro-cracking and delamination. Matrix micro-cracking develops first, causing delamination. The detection and quantification of matrix micro-cracks would provide the needed information to predict the development of delamination and the correct safety or maintenance decision to be made. The challenge in matrix micro-cracking identification is that it is a distributed damage, while delamination is a localized damage. The state-of-the-art diagnostic techniques are good at detecting and localizing major changes in sensor signals, which usually points to delamination, holes or other localized defects. Furthermore, there are a limited number of features that can be extracted from sensor signals, and most of them are affected by both delamination and matrix micro-cracking. The work presented in this paper aims at finding which features are more sensitive to each damage type (delamination or matrix micro-cracks), and applying machine learning techniques to learn and model a classifier that uses these features efficiently to classify the detected damage.

INTRODUCTION

Within the requirements of next generation aircraft and spacecraft is the need for fuel-efficient, cost effective, and safe vehicles. To meet these requirements the design of lighter and intelligent structures surfaces as a solution. To solve the lighter requirement, fiber reinforced composite structures offer the possibility to reduce structural weight compared to their metal counterparts. An intelligent structure is a

Cecilia Larrosa, Kuldeep Lonkar and Santhosh Shankar, Ph.D candidates, Department of Aeronautics and Astronautics, Stanford University, Durand Bldng., room 250, 496 Lomita Mall, Stanford, Ca 94305.
Prof. Fu-Kuo Chang, Dep artment of Aeronautics a nd Astronautics, Stanford University, Durand Bldng., room 250, 496 Lomita Mall, Stanford, Ca 94305.

191

Код: 10263

C.C. Larrosa, K. Lonkar, S. Shankar, F.-K. Chang

Damage Classification in Composite Laminates: Matrix Micro-Cracking and Delamination

Издательство DEStech Publications, Lancaster, 2011 год

9 стр; формат: 23,5 x 16 см; библиографический список: 17 единиц
ISBN: 978-1-60595-053-2

Fiber reinforced composites have been widely used in aerospace applications due to their functional properties, such as high strength-to-weight ratios. But many challenges remain to be overcome in order to permit more confidence in the performance of composite structures. In particular, composites have different failure types and modes that make damage prediction and propagation a very challenging subject. The main two damage types are matrix micro-cracking and delamination. Matrix micro-cracking develops first, causing delamination. The detection and quantification of matrix micro-cracks would provide the needed information to predict the development of delamination and the correct safety or maintenance decision to be made. The challenge in matrix micro-cracking identification is that it is a distributed damage, while delamination is a localized damage. The state-of-the-art diagnostic techniques are good at detecting and localizing major changes in sensor signals, which usually points to delamination, holes or other localized defects. Furthermore, there are a limited number of features that can be extracted from sensor signals, and most of them are affected by both delamination and matrix micro-cracking. The work presented in this paper aims at finding which features are more sensitive to each damage type (delamination or matrix micro-cracks), and applying machine learning techniques to learn and model a classifier that uses these features efficiently to classify the detected damage.

Ключевые слова:

Содержание.