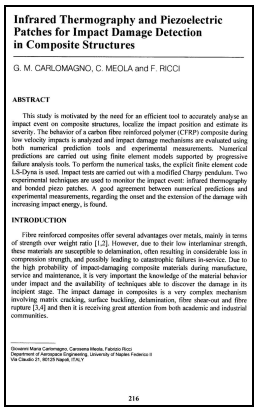
Infrared Thermography and Piezoelectric Patches for Impact Damage Detection in Composite Structures

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ABSTRACT

This study is motivated by the need for an efficient tool to accurately analyse an impact event on composite structures, localize the impact position and estimate its severity. The behavior of a carbon fibre reinforced polymer (CFRP) composite during low velocity impacts is analyzed and impact damage mechanisms are evaluated using both numerical prediction tools and experimental measurements. Numerical predictions are carried out using finite element models supported by progressive failure analysis tools. To perform the numerical tasks, the explicit finite element code LS-Dyna is used. Impact tests are carried out with a modified Charpy pendulum. Two experimental techniques are used to monitor the impact event: infrared thermography and bonded piezo patches. A good agreement between numerical predictions and experimental measurements, regarding the onset and the extension of the damage with increasing impact energy, is found.

INTRODUCTION

Fibre reinforced composites offer several advantages over metals, mainly in terms of strength over weight ratio [1,2]. However, due to their low interlaminar strength, these materials are susceptible to delamination, often resulting in considerable loss in compression strength, and possibly leading to catastrophic failures in-service. Due to the high probability of impact-damaging composite materials during manufacture, service and maintenance, it is very important the knowledge of the material behavior under impact and the availability of techniques able to discover the damage in its incipient stage. The impact damage in composites is a very complex mechanism involving matrix cracking, surface buckling, delamination, fibre shear-out and fibre rupture [3,4] and then it is receiving great attention from both academic and industrial communities.

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216

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Ключевые слова:

Содержание.