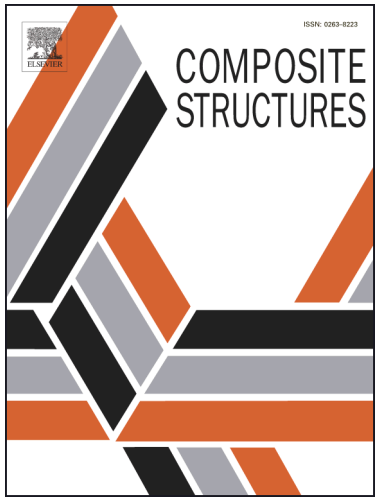

Post-Impact Damage Detection On A Winglet Structure Realized In Composite Material

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POST-IMPACT DAMAGE DETECTION ON A WINGLET STRUCTURE REALIZED IN COMPOSITE MATERIAL

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Abstract. In this work, a structural health monitoring system has been implemented with damage identification purpose on a winglet of a general aviation aircraft. Using a pitch-catch approach, guided waves (Lamb waves) have been measured by means of an array of piezoelectric sensors able to excite and record the dynamic response of the structure. The undamaged configuration has been used as reference state (baseline) for the Structural Health Monitoring (SHM) purpose while the damaged configuration (current state) has been obtained by low velocity impact test. The effectiveness of the damage has been verified using a Non-Destructive Inspection (NDI) by means of a C-SCAN Olympus Omni SX. The calculation of the damage index obtained comparing the measured wave propagation data in a reference state and the current state is introduced as a determinant of structural damage. Its calculation in different paths associated with the Probability Ellipse (PE) method has been used to identify the position of the damage. Additional radar graphs have been developed for the measurement of the directionality of the Lamb waves and further considerations have been introduced in order to evaluate the sensitivity of the Lamb waves with the aerodynamic load.

1 Introduction

The aeronautical industry is facing severe economic and ecological challenges. A significant enhancement of the aircraft performances is imperative to reduce the aircraft fuel consumption and then the pollutant emissions. New concept engines and innovative concept designs are the main drivers to reach this target. More efficient combustors allow, in fact, to decrease both the fuel consumption and the emission of the exhaust gas pollutants;, innovative concept designs, intended as new structural devices, or the use of morphing

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