

Non-Destructive Evaluation of Aircraft Cables Using Ultrasonic Guided Wave Technique

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Abstract

The degradation of aircraft wire structure over time due to environmental and operational conditions can potentially become a source of electrical unreliability. This consequently compromise the functionality of instruments and safety of the aircraft. Therefore, it is essential to develop an inspection technique to accurately determine the health of electrical wiring, in particular to inspect the condition of the insulation during maintenance efficiently. Recently, the use of Ultrasonic Guided Wave (UGW) has gained wide attention in the field of Non-Destructive Testing (NDT) notably in the application for pipeline inspection. In this paper, a mobile UGW system is developed by utilizing transducer based on Macro Fibre Composite (MFC). Numerical studies using Finite-Element Method (FEM) have been used to study the frequency and transient characteristics on the modes of wave propagation in wire structures. Representative aircraft cables with well classified insulation defects were subjected to the UGW inspection system operating at frequencies range of 10 – 20 kHz. The data acquired by the pulser/receiver unit was further processed with a Hybrid Defect Detection (HDD) algorithm in order to automate the result analysis. The results yield a standard deviation of 0.16 which provide an indication on the applicability of the proposed system to inspect small insulation defects for a length of 6 m cable bundle.

Keywords: Aircraft wires, ultrasonic guided wave, finite element method, pulser-receiver, hybrid defect detection algorithm.