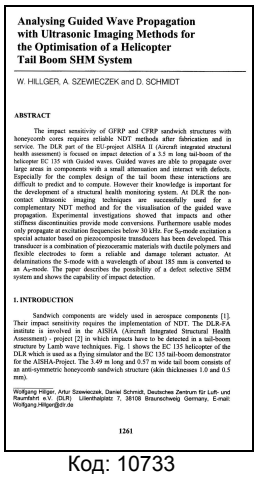

Analysing Guided Wave Propagation with Ultrasonic Imaging Methods for the Optimisation of a Helicopter Tail Boom SHM System

W. HILLGER, A. SZEWIECZEK and D. SCHMIDT

ABSTRACT

The impact sensitivity of GFRP and CFRP sandwich structures with honeycomb cores requires reliable NDT methods after fabrication and in service. The DLR part of the EU-project AISHA II (Aircraft integrated structural health assessment) is focused on impact detection of a 3.5 m long tail-boom of the helicopter EC 135 with Guided waves. Guided waves are able to propagate over large areas in components with a small attenuation and interact with defects. Especially for the complex design of the tail boom these interactions are difficult to predict and to compute. However their knowledge is important for the development of a structural health monitoring system. At DLR the non-contact ultrasonic imaging techniques are successfully used for a complementary NDT method and for the visualisation of the guided wave propagation. Experimental investigations showed that impacts and other stiffness discontinuities provide mode conversions. Furthermore usable modes only propagate at excitation frequencies below 30 kHz. For S_0-mode excitation a special actuator based on piezocomposite transducers has been developed. This transducer is a combination of piezoceramic materials with ductile polymers and flexible electrodes to form a reliable and damage tolerant actuator. At delaminations the S-mode with a wavelength of about 185 mm is converted to an A_0-mode. The paper describes the possibility of a defect selective SHM system and shows the capability of impact detection.

1. INTRODUCTION

Sandwich components are widely used in aerospace components [1]. Their impact sensitivity requires the implementation of NDT. The DLR-FA institute is involved in the AISHA (Aircraft Integrated Structural Health Assessment) - project [2] in which impacts have to be detected in a tail-boom structure by Lamb wave techniques. Fig. 1 shows the EC 135 helicopter of the DLR which is used as a flying simulator and the EC 135 tail-boom demonstrator for the AISHA-Project. The 3.49 m long and 0.57 m wide tail boom consists of an anti-symmetric honeycomb sandwich structure (skin thicknesses 1.0 and 0.5 mm).

Wolfgang Hillger, Artur Szewieczek, Daniel Schmidt, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) Lilienthalplatz 7, 38108 Braunschweig Germany. E-mail: Wolfgang.Hillger@dlr.de

Код: 10733

W. Hillger, A. Szewieczek, D. Schmidt

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Ключевые слова:

Содержание.