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Development and Testing of an Ultrasonic Phased Array System Based on Piezo Actuators and Fiber Optic Sensors

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In order to be able to monitor large areas of composite structures online, an active ultrasonic Phased Array SHM System based on Piezo-Actuators and Fiber Optic and / or Piezo Sensors was developed where approximately 8 piezo actuators and 4 fiber optic sensors are required to monitor 1 m² of a composite structure. In this concept an array of piezo actuators is actuated by a series of burst signals confined in time and frequency with a defined time delay producing an ultrasonic (US) beam in a predefined direction. The beam can be swept over the area to be inspected. The beam interferes with a potential defect in the structure producing a backscattering of the US beam which will be measured by the fiber optic sensors. The captured signals will be fed in a post processing routine to visualize and quantify the damaged region. A lab based SHM system based on the mentioned technology consisting of the piezo actuators with its actuation hardware, the fiber optic sensor with its opto-electronic hardware and the control and data acquisition unit was set-up. The system was tested on several panels made of Aluminium and CFRP with different types of damages -holes and impact damages - between 300 and 800 mm² of overall size. All data collected were fed in a data evaluation algorithm and post processed. After first verification of the ability to detect, locate and quantify the introduced damages the system was tested on an A340 spoiler from FACC damaged by typical impact damages producing an overall delamination area of 300 to 1000 mm².

Ключевые слова:

Содержание.

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