

Abstract ID-053

ASSESSMENT METHODS FOR COMPOSITE AEROSPACE STRUCTURES

**Tomasz Wandowski, Pawel Malinowski, Maciej Radzienski, Szymon Opoka,
Wieslaw Ostachowicz**

Polish Academy of Sciences - IFFM, Poland

*tomaszw@imp.gda.pl ; pmalinowski@imp.gda.pl ; mradzienski@imp.gda.pl ;
szop@imp.gda.pl ; wieslaw@imp.gda.pl*

Keywords: Laser Vibrometry, Electromechanical Impedance, Thz Spectroscopy, Composites

Summary: In this paper result of detection and localization of artificially initiated delaminations in small carbon fibre reinforced polymer CFRP and glass fibre reinforced polymers GFRP samples were presented.

The first method was electromechanical impedance method (EMI). This method utilizes electromechanical coupling of piezoelectric transducer with host structure. Due to this coupling mechanical resonances of structure can be seen in electrical impedance characteristic of piezoelectric transducer. Instead of electrical impedance other parameters such as resistance, conductance, admittance or susceptance are very often utilized. In the research real part of electrical impedance (resistance) was measured. Delamination in CFRP sample caused frequency shift of certain resonance frequencies visible in resistance characteristic.

The second method was a laser vibrometry. It is a noncontact technique that allows to measure vibration of structure excited by piezoelectric transducer. During research standing waves (vibration-based method) and propagating waves (guided waves-based method) were registered for CFRP sample. In the vibration-based method, the frequency shifts of certain resonance frequencies were analyzed. In guided waves-based technique, the interaction of elastic waves with delamination can be seen in the RMS energy map.

The third method is Terahertz spectroscopy. The device uses an electromagnetic radiation in the terahertz range (0.1–3 THz). The spectrometer is equipped with moving table that allows for XY scanning of large objects. During research the scanning heads working in reflection mode were utilized and the measurements were taken for GFRP sample with delamination. During research time signals as well as sets of signals creating B-scans and C-scans were analysed. The obtained results showed that the THz spectroscopy technique can detect and visualize delamination between the GFRP layers.