

DIAGNOSTICS DEVICES FOR COMPOSITE CONSTRUCTIONS

In the global aircraft engineering, there are new technological solutions, providing both the flight safety and maximum cost-effectiveness of the aircraft maintenance. Substantially, they are achieved due to the increasing usage of composite materials in airframe constructions. Wide usage of composites requires new approaches to the development and manufacturing of aircrafts as well as to their technical service and repair, including the provision of qualitative diagnostics.

Graphite-epoxy and glass-fibre plastic composites are widely spread. Perspectives and scale of usage of composite materials in the aircrafts of the nearest future can be obviously seen on example of the aircrafts Boeing 787 and A350XWB. The airframes of American and European airplanes will be 50% and correspondingly 53% manufactured from composites. This material will be used for the fuselage units, wings, fairings and other units. A considerable part of composite constructions will be provided in the new regional airplane "Sukhoi Superjet-100". Composites are also widely used in the military aviation.

The company "Votum" is one of the production leaders in the branch of ultrasonic flaw detectors, including those for the aviation industry, for which the acoustic and low-frequency ultrasonic devices for testing of composites have been developed. "Votum" is the NDT designer and supplier of practically all aircraft repair and maintenance enterprises of Russia and CIS. The range of the NDT products supplied by the company "Votum" is divided into specialized devices (DAMI, TERI) and general purpose devices (UD4-T). These devices allow to detect main defects of the composite structure: delaminations, cracks, density anomalies.

BonDetector DAMI-C

DAMI-C universal bonddetector of aviation materials (trade mark BonDetector) combines the impedance, impact and eddy-current testing methods. Due to its unique functional capabilities, it allows to automatize the process of defects detection; the transducer is automatically set for the testing object, taking into account the tested material properties. The specific software is provided for each testing method:

"Impedance bonddetector" - testing and detection of such defects as disbands, delaminations and density anomalies for a wide range of honeycomb and composite materials and building of C-scans of detected defects;

"Impact bonddetector" - express testing of wide



areas of honeycomb and bonded structures and building of interpolated images of tested areas;

"Low-frequency eddy current bonddetector" - testing and detection of corrosion hearths on the reverse sides of non-ferromagnetic metal and alloy sheets in constructions for different purposes and building of corroded area images.

"High-frequency eddy current bonddetector" - detection of cracks appeared on the tested surface for a wide range of electroconductive parts: rods, tubes, sheets, plates, coatings including the multilayer ones, nuclear reactor vessels, bearing balls and rollers, fastening parts, etc.

The device is designed on the basis of modern elements; equipped with the hardware and specialized software, providing the collection, processing and displaying of current testing results on the screen in the real time mode. Testing results are stored in the device archive and transmitted into the PC.

Impedance tester TERI

TERI device is designed for the application in the aviation industry and is intended for the impedance express testing of multilayer soldered, bonded composite materials and constructions with a honeycomb filler to detect such defects as delaminations and disbands. The possibility to determine the relative value of local impedance in the testing object allows to evaluate indirectly the sheet material thick-



ness. The availability of the complex plane mode with displaying of the friction noise zone widens the possibilities of device setting for different surface roughnesses.

The device is simple for setting and operation. The process of TERI setting is completely automatized and takes a little time. The device will set itself the necessary value of the defect alarm actuation threshold.

TERI is applied in the aviation industry as a modern alternative for the technically outdated procedures of the mechanical honeycomb structure rapping. TERI is a modification of the bonddetector DAMI-C.

On results of the departmental examinations in the GosNII GA, DAMI and TERI devices were recommended for the aviation industry, for the impedance testing during the repair and maintenance of the aircrafts Il-86, An-124, Tu-204, Tu-214, Yak-42, etc.

UD4-T flaw detector

The ultrasonic flaw detector comprises the whole complex of specialized flaw detectors for different purposes and testing methods, meas-



ures the depths of defects and coordinates of their occurrence, propagation and damping velocity of ultrasonic vibrations in the material. The identity of interfaces allows to master easily all new software. The device is intended to be applied under field (aerodrome), shop floor and laboratory conditions. Following application software is intended to be applied in the aerospace branch:

"Tomographic 1.1" - general purpose flaw detector.

"Tomographic 1.2" - EMA/UT thickness gauge for the UD4-T provides simultaneously the functional capabilities of the EMA (electromagnetic acoustic) and UT (ultrasonic) precision thickness gauge with A and B scan. The EMA transducer can be used for all electroconductive materials. Ultrasonic waves are formed directly in the material. It allows to work with the materials, having dirty surface (rust, corrosion, etc.) and different paint-and-lacquer coatings.

"Tomographic 3.1" - resonance flaw detector. Is intended to test workpieces for detection of delaminations in composite materials and disbands in the workpieces bonded of metal materials.

"Tomographic 4.1" - eddy current flaw detector is intended for the eddy current testing of electroconductive non-magnetic and ferromagnetic parts to detect cracks, delaminations, backfins, abscesses, nonmetallic inclusions on the surface of non-magnetic and ferromagnetic metal and alloy parts. The requirements to the quality assessment of tested objects differ from each other, testing methods differ correspondingly. The choice of the NDT method will depend on the tested object, defect kind or type, size, location, required velocity and degree of testing, etc.

The company "Votum" has more than 30 years experience of development of the NDT equipment. The above-mentioned devices and testing procedures for aviation constructions, including the composite material constructions guarantee the high qualitative diagnostics during the manufacturing, technical service and repair of the aircrafts.



The company "Votum" invites the domestic and foreign partners to the mutually profitable cooperation!

VOTUM Ltd, Leningrad av. 80
Postal address: 125195, Moscow, p/b 52
Tel.: +7(495) 662-59-38
Fax: +7(495) 229-02-89
E-Mail: office@votum.ru