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FILTERING OF INTERFERENCE OF INHOMOGENEOUS REGULAR STRUCTURE IN THERMAL NON-DESTRUCTIVE CONTROL OF CELLULAR STRUCTURES

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ABSTRACT

Honeycomb constructions are the most widely used ma-terials in contemporary aviation and space technology. They are the basis for the housings of practically all products of this sector, where reliability of all parts should meet the in-creased requirements. Special attention is paid to the quality of composite materials and to the absence of defects such as the places of adhesion failure (exfoliation) between the skin and the honeycomb filler.Therefore, increase in the efficiency and reliability of thermal flaw detection, based on in-depth analysis of the processes of detecting defects and development of the prin-ciples of optimization of both the procedure of control and subsequent processing of the obtained information, is an important and relevant task.

Keywords: honeycomb structure, thermal flaw detection, emissivity.

Cellular structures are one of the most common structural materials in aviation, space technology and other industries, where the reliability of components is subject to increased requirements.

In order to improve the quality of the investigated materials, the present studies search for ways to suppress interference that reduces the accuracy of quality control by creating algorithms for processing thermograms obtained as a result of thermal non-destructive testing.[1]

To achieve the goal, a theoretical-experimental approach was used, combining the construction and analysis of a thermophysical model of a cellular structure [2] and the experiment on real samples with defects.

One of the most image affecting interference is the interference caused by the internal regular pattern of the control sample. It does not depend on the state (defect) of the sample and is present in all products of complex internal structure.

In this work, the second method was used much less universal, but in this case more efficient. The regular structure results in an alternating change in the thermal resistance of the RTs for which the condition $F=a/b=const$ is met, which leads to the appearance of temperature contrasts on its surface reaching values (as shown by the experiment) 2,1°C, which is comparable to a useful signal ΔT caused by the presence of a defect. However, analysis of the experimental data obtained showed that these contrasts differ from the useful signal in space-time dependence $\Delta T(\tau, x)$. This fact formed the basis of the proposed method of suppressing this interference by computer processing of thermograms using dependence $\partial T(x)/\partial x$.[3]

The essence of this method is to calculate a two-dimensional matrix, the elements of which are the corresponding partial time derivatives.

By filtering the obtained image using the obtained dependencies, the final appearance of the thermogram is obtained. Comparison of this thermogram with the initial one confirms the fact that the reliability of detection of defects using the proposed method has increased significantly, after processing the detection of defects has increased by 1.3 times. [1.3]

This creates all the prerequisites for moving from a visual method of identifying defects to an automated method based on the corresponding technical means in production conditions.

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