Active infrared testing of composites using 3d computer simulation

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Abstrak

Composite sandwich constructions are very widely employed in the modern aircraft industry, honeycomb panels among them. The principal defects of honeycomb sandwiches are cover detachment because of cell collapse or poor adhesive, which can lead to water penetration in cells. Recently, the thermal method of non-destructive testing (infrared thermography) has begun to be applied to the diagnostics of honeycomb constructions, and has some advantages over traditional methods. However, thermal processes are transient, and this complicates the selection of optimal parameters for monitoring. The purpose of this work is to investigate the possibilities of the thermal method for honeycomb panel inspection using computer simulation. The COMSOL Multiphysics package was used for the simulations. A 3D model of the honeycomb panel was proposed, and two possible defects considered: the detachment of the panel cover from the filler and the presence of water in the defective cell. The implementation of the proposed 3D model made it possible to investigate the effect of a defect on the thermal field of the panel surface. The simulation results showed that optimal testing time is significantly different for various types of panels. The correct selection of testing parameters increases the accuracy of the testing procedure. The results of experimental investigation confirmed the adequacy of the proposed model for thermal testing.