Comparing nondestructive techniques to detect intruded solid, liquid and gaseous materials in honeycomb sandwich panels

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Abstract:
Honeycomb sandwich panels are widely employed as aircraft construction materials in primary and secondary structures. Damage and defects are to be identified and quantified in order the part be promptly repaired, its structural integrity guaranteed and so the fleet airworthiness. For this purpose, an assortment of nondestructive techniques is now available and under permanent evolution. One of the most recognized issues in regard to the application of nondestructive techniques in such task is that no single method is able to cover the wide range of problems which can arise during in-service conditions, so that most frequently more than one methodology is used to certify that a good job has been accomplished. Also, during periodical nondestructive inspection of aircraft structural parts the operator must certify that multiple defects and damages are undoubtedly distinguishable from each other and mainly from constructional details of the piece, which are made from materials like metals, polymers and so. Another challenge typically found during nondestructive inspection of helicopter blades is to differentiate entrapped fluids (e.g. water, kerosene, hydraulic fluid) from solid resin spots created from previous repair operation. In this work, nondestructive techniques like conventional and digital x-ray radiography, long pulse transient thermography, neutronography and transmission ultrasonics were employed to discriminate different kind of solid, liquid and gaseous materials which were intentionally introduced in the core of an aircraft honeycomb sandwich panel. The advantages and shortcomings of each methodology are discussed in terms of its ability to not only imaging the intruded materials but mainly offering to the operator unequivocal information about their chemical nature, composition and physical state.

Keywords: NDT-wide, Concurrent NDT methods, Damage & defect, Honeycomb panel