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Full field measurements applied to the experimental testing of structural parts for the aerospace industry

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ABSTRACT

The design and validation of efficient and airworthy aircrafts in the aerospace industry relies on the Building Block Approach (BBA), a multiscale testing validated approach. Structural tests required by this method require a large amount of data from various types of instrumentation to measure local information about the structure being tested. (e.g. strain gages, accelerometers. variable differential transformers, …). The aim is to demonstrate predictability from the simulation model of the outcomes of the test. Digital image correlation (DIC) is a non-contact optical method that delivers full-field measurements by correlating a reference image with a series of deformed ones. The most common method, the subset based method, is to track sub-regions of a random speckle pattern applied on a subject to analyze. This work will present an application of full field measurement techniques applied to the structural testing of a small scale composite wing (developed by Bombardier Aviation) using multiple stereo-DIC setups.

Downbending and upbending static tests will be carried out on a small scale composite wing while being observed using 3 different stereo-DIC setups. The wing will also be equipped with standard instrumentation used to measure local deformations. The experimental results will be explored in order to determine if full field measurements methods could be used to replace standard instrumentation techniques as a cheaper and more efficient measurement tool. The validity and relevance of full field measurement methods will also be determined through a quantitative comparison with a Finite Element (FE) model of the wing. Finally, the ideal number and optimal positioning of the stereo DIC cameras necessary to provide as much information as standard instrumentation will be presented and discussed.

Due to the confidential nature of the structure involved, this work will only present normalized experimental results and a qualitative description of the structure involved, its manufacturing and internal structure.

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