

Case Study: **Leonardo Company**

Computation of Allowable values for CRFP

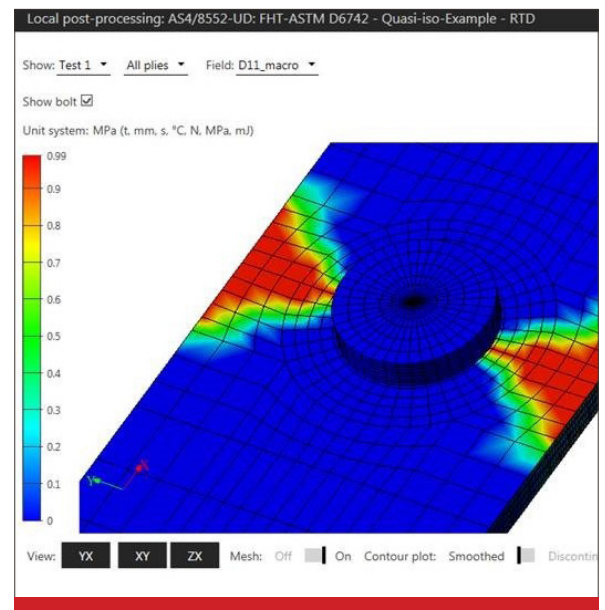
Old expensive test campaign ready for scrapping?

Overview

Design and certification of composite structures require accurate values for the material strength, known as A & B-basis allowables. The main need of allowable campaign is to collect these values for all the different configurations in which a structural part has to deal with once it is assembled on the aircraft. One of these tests concern the Filled-Hole coupon test performed in tension and compression where a bolt, such as a protusion or countersunk, is tightened inside a central hole.

The use of a vertical solution like Digimat VA allows to investigate all the configurations under consideration for the design and virtually compute the composite material's allowables.

The aim of the project was to predict and validate the Mean Strength Value and the B-basis Allowable at the Room Temperature Ambient (RTA) condition for the Filled-Hole coupon. Quasi-isotropic lay-up of a 58% carbon fiber is used.



“Digimat-VA reduces the number of coupon tests for material qualification, accelerates the trade-off studies in the down-selection process for qualifying new materials, certifying new components and improves the aircraft performance identifying the critical material and manufacturing variables to maximize material performance for a given application. The introduction of a dedicated computer-aided environment, as Digimat-VA, in regulations can have clear benefits potential in terms of reduction in coupon tests by more than 65%”

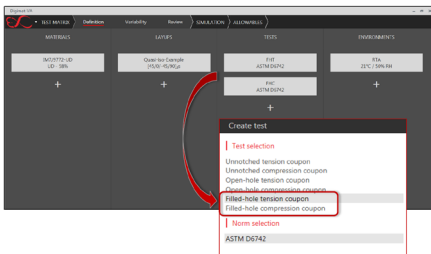


Salvatore Russo, Leonardo

Solution

For this study, we used a semi-automatic workflow but the modeling of the Filled-Hole test has been integrated within Digimat - VA and is available now as a standard new feature.

The aim of the present activity consists in inserting a new capability within Digimat - VA which allows to perform the Filled-Hole tension and compression simulation and, then, calculate the associated allowables. The Digimat platform has been used for the material behavior modeling and for the execution of the test simulation.



Filled-hole standard ASTM test as a new capability

Results/Benefits

Digimat-VA allows to reduce testing costs and time, giving a potential reduction in coupon tests by more than 65%.

Digimat-VA also helps screening faster various material systems for which tests data aren't available, supporting adequate material selection prior to running some complementary test.

Results Validation/ Correlation to Test Data

The virtual simulations showed very good correlation with the experimental values. In particular, the maximum error remains below 8%. Also failure mode, contact status can be verified by simulation.

Normalized B-basis Strength Allowable			
Load	Experimental	Digimat-VA	Error %
Tension	1.00	0.92	-7.79
Compression	1.00	0.97	-2.55

Comparison between test and simulation

Key Highlights:

Product: Digimat-VA

Company: Leonardo
Company Aircraft Division

CAE Technology: Finite
Element Analysis

Material: CFRP

Industry: Aerospace &
Defense

Application: Filled-hole
Tension and Compression
test on CFRP – UD laminate

Performances: Progressive
Damage Simulation

For more information on Digimat and for additional Case Studies, please visit www.e-Xstream.com

e-Xstream engineering
ZAE Robert Steichen - 5 rue Bommel
Hautcharage, L-4940 Luxembourg
Telephone 352.26.17.66.07
www.e-Xstream.com

