esrd Engineering Software Research & Development, Inc.

ESRD, Inc. is the developer of StressCheck®, the world's premier high definition simulation tool

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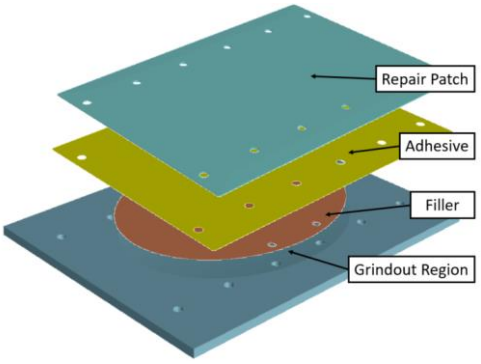
Detailed Analysis of Bonded Repairs

Fatigue-related effects are a significant cost driver for maintenance of military aircraft systems. Typically, inspection intervals are defined based on expected damage accumulation or crack initiation and propagation rates. When damage is found, a decision must be made on whether the damaged component should be removed, repaired, or left alone until the next inspection. Repairing may include material removals and/or the installation of a patch, which requires additional engineering decisions as to the extent of the removal or the type and size of patch to maintain structural integrity and performance.

The Engineering Challenge

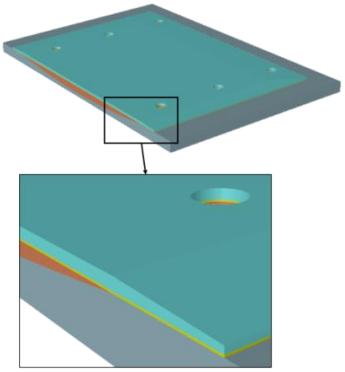
The objective is to provide a repeatable and reliable methodology for damage tolerance (DaDT) analysis of wing structures prior to and after the installation of repair patches. ***StressCheck Professional*** is ideally suited for modeling repairs using the finite element method to quantify the severity of damage and evaluate the effectiveness of a given repair in restoring static strength and improving fatigue life.



The Simulation Solution

In the case of applying bonded repairs to a wing skin with corrosion damage, the simulation explicitly includes the grindout required to remove the damage, the filler material, and the layer of adhesive to bond the patch, ***all using 3D-solid elements***. For the adhesive and doubler, hex-dominant meshes are automatically generated via a novel meshing method applicable to thin domains.

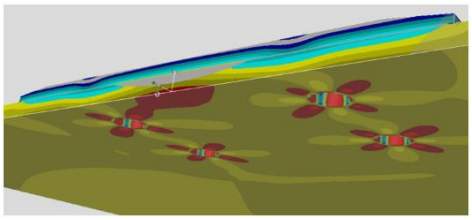
A material nonlinear analysis is then performed to account for the local plasticity of the adhesive in the evaluation of static strength of the repair as well as for damage tolerant calculations when a crack is introduced in the repaired skin. The static strength of the repair is then compared with the pristine condition, and the crack growth rate is compared with that of the original structure.



The Value

Aircraft are commonly being flown well past their original expected service life, and the value derived from improving the productivity and reliability of DaDT analysis functions to support the inspection, maintenance, repair, and life-extension of today's aerostructures is substantial.

StressCheck's implementation of numerical simulation is designed to support solution verification, an essential technical requirement of Simulation Governance. The implementation makes it possible to encapsulate complexity, improve productivity, contain costs, and ensure the reliability of results for the expert simulation analyst as well as the non-FEA expert DaDT engineer.



Learn more at esrd.com/about/safer-simulation

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