Autodesk® Helius PFA
Delamination

How does Helius PFA compare to competing analysis methods?

In this example, we analyze a tension-loaded composite skin stiffener. Autodesk Simulation Composite Analysis software is compared with the cohesive technology provided in other commercial finite element analysis (FEA) platforms. The same FEA model and work station are used for both cases.

Converging on delamination

Autodesk Helius PFA improves composite delamination prediction capability by combining its intelligent discrete softening method (IDSM) with cohesive zone modeling to provide robust simulation convergence.

How can this positively impact your design process?

Cohesive zone modeling has been shown to be the most accurate method for predicting the initiation and progression of composite delamination, but its computational burden and convergence issues have precluded it from many analysis efforts. Those limitations need not exist.

Autodesk Helius PFA gives you an accurate, efficient solution for delamination predictions.

Learn more at http://www.autodesk.com/products/helius-pfa/features/all/gallery-view

Example

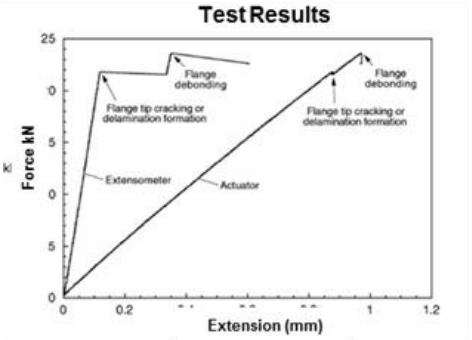
Results of the existing commercial solution are shown at right for four different values of viscosity (required to aid in convergence).

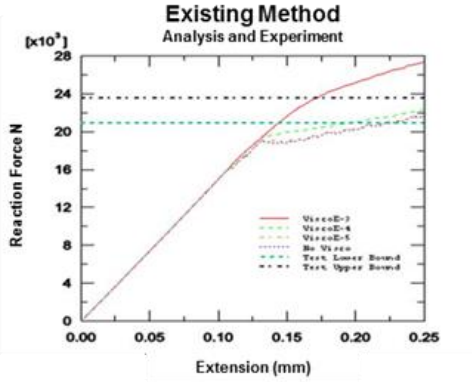
- There are four different solutions for 4 viscosity values.
- None of the solutions match the load/deflection response from the experiment.
- No matrix cracking is reported; only de-bonding is modeled.
- Run time = 179 minutes (x 4 viscosity values).

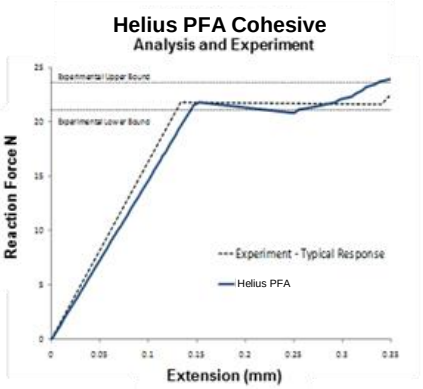
In comparison, Helius PFA does not require a viscosity study and is able to simultaneously capture matrix cracking in the skin and flange as well as the debonding in a fraction of the time.

How is this possible?

The key is Autodesk Helius PFA's unique combination of multiscale progressive failure technology and the convergence-enabling intelligent discrete softening method (IDSM).







	Helius PFA	Competition
Global Response	Accurate	No
Local Response	Accurate	No
Run Time	13 minutes	180 minutes
Viscosity Study	No	Yes

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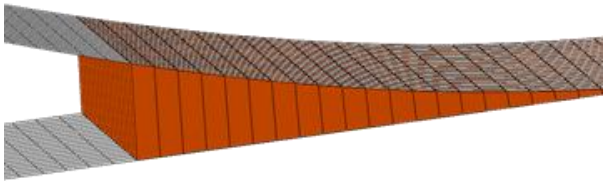
Why use a cohesive element-based approach instead of a VCCT node-based approach?

Though it is widely used to simulate composite delamination, there are significant limitations to the VCCT method. The following provides some reasons you should consider using cohesive zone modeling.



	Autodesk Helius PFA Cohesive zone modeling	VCCT
Delamination initiation & delamination propagation	Predicts both delamination initiation and propagation	Does not predict delamination initiation; only predicts propagation of existing delaminations
No-penetration boundary conditions for delaminated surfaces	Does not require the imposition and management of no-penetration boundary conditions for delaminated surfaces	Requires the imposition and management of no-penetration boundary conditions for delaminated surfaces
Parallelization of the simulation process	Is completely amenable to parallel solution (linux cluster) since the global delamination behavior is completely dictated by the independent delamination behavior within each individual cohesive element (no coupling between adjacent cohesive elements)	Is not amenable to parallel solution (linux cluster) since the global delamination behavior at each node depends collectively upon the loads borne by all elements that utilize the node in question
Compatibility with other nonlinearities	Is completely compatible with any other forms of nonlinearity that are simultaneously present in the solution (i.e., CZM is a generally applicable methodology)	Assumes linear elastic fracture behavior, thus any other nonlinearities that are present must be fixed (held constant) at any particular point in time where the energy release rate is computed and the crack is advanced

How can this positively impact your design process?

Present roadblocks to a comprehensive composite simulation that includes prediction of intra-laminar crack initiation and propagation need not exist. Cohesive technology can eliminate the need for a priori crack information and provide the capability to simultaneously consider inter- and intra-ply damage evolution.

EXPAND YOUR SIMULATION CAPABILITY

Autodesk Helius PFA offers a complete in-plane and out-of-plane simulation solution

* The performance results and statistical information reported in this paper were derived from tests carried out by Autodesk and conducted over a controlled network in which participants with varying levels of expertise with Autodesk Helius PFA and a competitive VCCT application performed selected tasks designed to simulate day-to-day production tasks using each solution. As with all performance tests, results may vary based on machine, operating system, filters, and even source material. While every effort has been made to make the tests as fair and objective as possible, your results may differ. Product information and specifications are subject to change without notice. Autodesk provides this information 'as is,' without warranty of any kind, either express or implied.

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