



## Setting a New Standard in the Analysis of Composite Structures and Bonded Joints

**StressCheck Composites** delivers state of the art FEA technology for the analysis of laminated composites and adhesively bonded joints. The hierarchical element formulation and modeling framework makes reliable and accurate analysis of composites a reality! Whether you are an analyst or a designer – you need **StressCheck Composites!**

Years of focus and attention to the needs of the aerospace industry have made **StressCheck Composites** the premier FEA tool on the market today for simulating the behavior of composite structures and bonded joints. A composite research team from the aeronautics industry, known as the Composites Affordability Initiative (CAI), conducted an extensive study of existing capabilities in the area of failure analysis tools for composite bonded joints. The study led the CAI team to unanimously select **StressCheck Composites** as the software tool to “replace as well as radically improve existing industry standard software currently used for sizing bonded joints.”<sup>1</sup> Combine these capabilities with other **StressCheck**<sup>®</sup> technologies, such as large aspect ratio elements or nonlinear analysis, and you can efficiently analyze composite and bonded structures for various failure modes.

*“Aerospace scientists and engineers now have a new state-of-the-art software product called StressCheck, which provides efficient and reliable analysis tools for composite bonded aircraft structures. A [study by a] composites research team ... known as the Composites Affordability Initiative ... led the team to unanimously choose StressCheck as the software tool to replace as well as radically improve existing industry standard software currently used to size bonded joints.”*

**Air Force Research Laboratory  
CAI Team: Bell Helicopter, Boeing,  
General Electric, Lockheed Martin,  
Northrop Grumman, US Air Force, US Navy**

*“StressCheck’s quality control features have given us the tool we need to perform detailed composite bonded joint analysis with confidence that the results are accurate.”*

**The Boeing Company**

*“This software tool will play an important role in making composites more affordable ... [and] provides a ... tool that will replace the FEM tools and failure criteria the experts currently employ for analyzing bonded joints. The software includes an FEM-based handbook format which allows non-experts to utilize models prepared by specialists.”*

**Lockheed Martin**

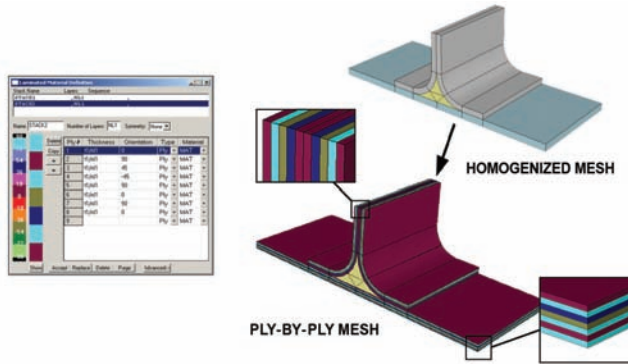
<sup>1</sup> Air Force Research Laboratory (AFRL) – May 1999



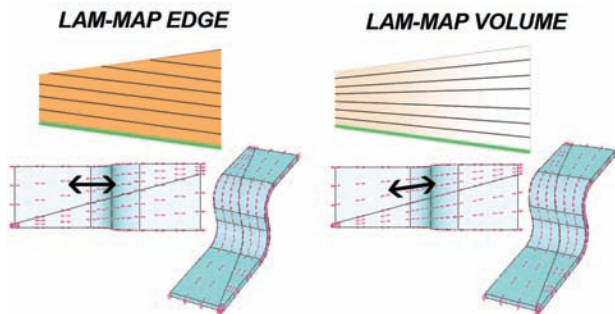
A powerful, reliable tool for detailed stress analysis of composite structures and bonded joints – from unique modeling capabilities, to advanced analysis technology, to powerful post-processing functions. Only StressCheck Composites brings this power to you in an easy to use framework. See why the CAI Team chose StressCheck Composites and why others are turning to it. Try StressCheck Composites today!

### MODELING AND ANALYSIS

StressCheck Composites' unique features facilitate modeling of composite materials and bonded structures. The Automatic Laminate Builder greatly reduces the time to define the composite layup. You enter the material properties and the ply layout and assign those properties as homogenized (or lumped), similar to other FEA programs. But with StressCheck Composites' unique auto-lamination tool, you can also automatically create elements representing individual plies which coupled with StressCheck's® unique hierarchical element formulations enable highly detailed stress analysis. StressCheck Composites' color coded display lets you graphically verify the ply angles in the laminate stack.



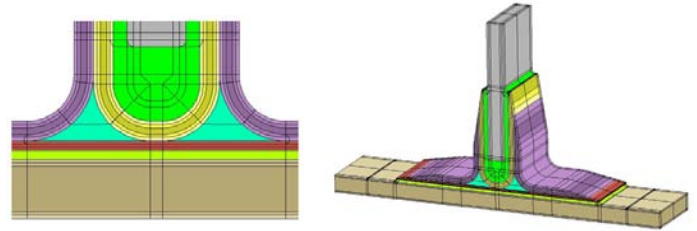
Material directions can reference Cartesian or cylindrical coordinate systems. However, in many practical problems a more general curvature approach is needed. StressCheck Composites has two unique capabilities allowing you to align the material properties with the curvature of an element with Lam-MapEdge, applicable to situations in which laminated components are created by stacking pre-preg plies, and with Lam-MapVolume, useful when modeling injection molded parts that include cut fibers which orient themselves with the mold



StressCheck Composites allows you to display arrows representing the principal material direction for laminates, which is particularly useful when visualizing the ply angle orientations.

StressCheck's thin solid elements allow substantial savings in computational time, without compromising the quality and accuracy of the solution. This is extremely valuable when analyzing composites where ply-by-ply modeling is used.

StressCheck's advanced FEA formulation allows high aspect ratio elements, for example 200:1 or even larger, enabling ply-by-ply element modeling while reducing model size. StressCheck's powerful element formulations also allow vanishing angle elements necessary to mesh the noodle or filler areas, without compromising the quality of the results.



### POST PROCESSING

In response to a request from a task group of the Composites Affordability Initiative, StressCheck Composites offers the ability to test for failure at multiple locations simultaneously. This unique feature is available in the nonlinear Margin Check analysis module.

StressCheck Composites allows you to extract results for a laminate as well as an individual ply within a laminate. Stress or strain results are available in the material direction of each ply, in addition to the global or other coordinate system directions. Primary quantities used to assess failure of composites, such as the first strain invariant J1 and volumetric strain can be calculated through the Failure Criteria Interface. You can also combine the mechanical and thermal strain effects to determine the onset of failure in composite structures. StressCheck's powerful Fracture Mechanics capabilities integrate with StressCheck Composites to allow extraction of the Energy Release Rate Components (ERR) using the separated J-integral. StressCheck Composites combined with Fracture Mechanics is also useful in assessing delaminations in composite structures. For example, delaminations can occur in the noodle area of a bonded composite joint. Of course, all of the features of StressCheck are available as you analyze your structure for potential failure.

### STRESSCHECK HANDBOOK

Combining StressCheck Composites with StressCheck's unique Handbook framework allows advanced technology such as the analysis of laminated composites to be packaged for use by both analysts and non-specialists. Parameterized models of complex laminated structure can be developed by a qualified analyst and delivered in a very convenient and highly reliable handbook environment for use by designers and analysts.

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