SIEMENS

Siemens PLM Software

What's new in Fibersim 14

Speeding the process for the design, analysis and manufacturing of composite products

Benefits

- Easily perform optimization loops between CAE pre- and postprocessing and Fibersim with zone-based CAE exchange
- Accurately define desired fiber orientations to meet analysis structural requirements with fiber field and compare rosettes
- Achieve designs and make changes faster with unique multi-ply design methodology
- Create desired ply boundary geometry quickly with fill-to-curve and extend-along-curve transitions

Summary

The latest release of the Fibersim™ portfolio of software for composites engineering makes analysis, design and manufacturing composite products on NX™ software and other computer-aided design (CAD) systems faster and easier than ever before. Analysis enhancements such as zone-based computer-aided engineering (CAE) exchange make the exchange of composite definitions between CAE and CAD more efficient and enable you to optimize the design much faster. Optimization often requires a proper definition and understanding of the desired fiber orientations.

Fibersim 14 now lets you review the mapping of desired fiber orientations across a laminate to ensure that you are achieving your objective. Design efficiency is also increased with a new design method and a way to ensure that you achieve the ply shapes you want in the most automated fashion. One of the biggest challenges of engineering a composite part is creating a an accurate inner mold line (IML) and net part solid, which is now delivered through parametric surface offset technology in a push button fashion. Manufacturing consistency and throughput for composites can be hard to achieve, but Fibersim documentation now introduces ply book and ply table capabilities on the PTC Creo® platform.

Fibersim for analysis and design productivity

Benefits of zone-based CAE exchange:

- Eliminate errors
- Enable increased part optimization
- Provide an interface to NX Laminate Composites and other leading CAE solutions

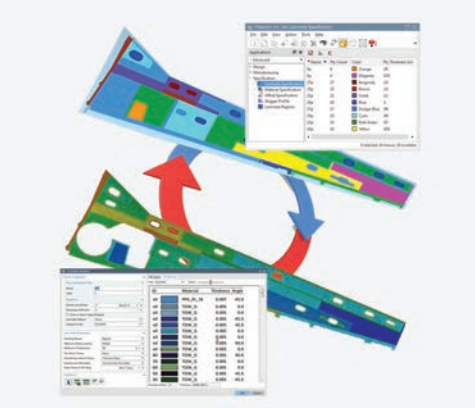
Zone-based CAE exchange

The ability to exchange composite definitions between an analyst and designer ensures efficiency and eliminates errors to provide a way to achieve composite part optimization. Optimization of composite

What's new in Fibersim 14

Benefits *continued*

- Automatically generate a solid of the composite part net shape with parametric surface offset technology
- Increase production consistency and throughput with ply books and ply table 2D documentation on the Creo platform



Fibersim 14 and NX Laminate Composites can be used to exchange zone-based composite definitions, making starting and modifying designs easier.

parts leads to reduced product weight, material costs and production costs. The zone-based CAE exchange delivers the same bi-directional capabilities for zone-based design that existed for ply-based designs. The zone-based CAE exchange uses a standard for composite definition within a hierarchical data file format (HDF5) that was developed by Siemens PLM Software in conjunction with leading CAE solution companies. The zone-based CAE exchange allows the re-use of a preliminary design developed in CAE pre- and postprocessing solutions, including NX Laminate Composites and Fibersim. The format includes both the material requirements and the geometry that defines the zone or location to apply the material requirements. In addition, the user interface makes it clear if the zone geometry and material specification have been previously imported to help avoid errors during the iterative development process.

Fiber field and rosette comparison benefits:

- Verify the definition of desired fiber orientations
- Increase confidence in expected material properties
- Improve structural reliability

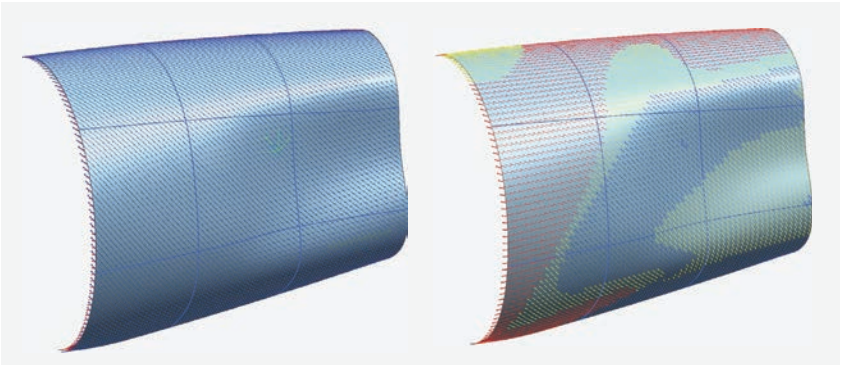
Fiber field and rosette comparison

Making sure that an analyst's desired fiber orientations in the finite element model (FEM) are redefined properly in the Fibersim model is critical for making sure that lower factors of safety can be used to achieve appropriate structural performance. The fiber field rosette highlighting capability lets you visualize the mapping of fiber orientation across the entire part based on the type of rosette used. To further ensure the similarity between the desired fiber orientations and the Fibersim model, the rosette-compare utility allows the engineer to compare different rosette mapping types. CAE rosettes are typically used to map fiber orientations based on the translation of a coordinate system to each element. Fibersim can be used to compare this or other rosette mappings showing variance direction vectors of each rosette type in a colored array that is based on acceptable values of variance.

Field rosette highlighting shows the vectors across the entire laminate surface, enabling verification of fiber orientations.

Multi-ply design method benefits:

- Achieve design automation
- Eliminate the complexity associated with zone-/grid-based designs
- Make design changes quickly



The rosette comparison utility shows vectors of the variance between two rosettes in colors relating to the size of the variance, including blue (small), yellow (medium) and red (large).

Multi-ply design method

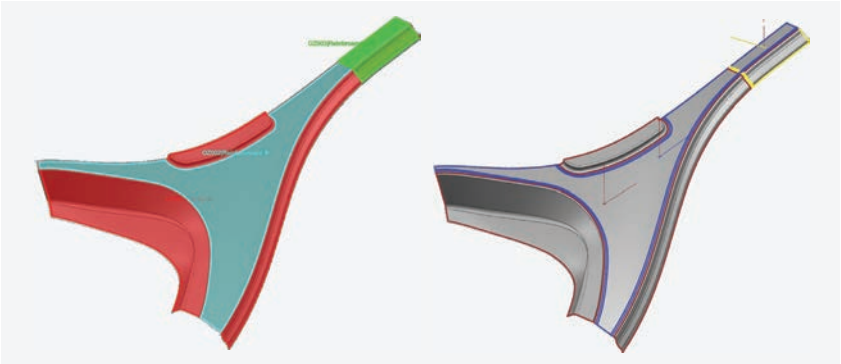
Ply-based designs are typically manual and time consuming because the boundary geometry for each ply must be created. Zone-based designs are automated and fast, but difficult to understand for engineers who are newcomers to composite design because the ply shapes are indirectly determined by material requirements of part regions. Multi-ply design achieves the automation of zone-based designs but provides a more direct understanding of ply shapes. Multi-ply is a unique, automated specification-driven design methodology. The engineer is able to define specifications for material, material groups, drop-off profiles and drop-off spacing that are associated with different base shapes. The base shapes are independent, allowing them to be on top of or overlap one another. The specifications manage the creation of the ply boundary geometry and definition. During the iterative design process, changes can be made quickly by managing the specifications and not the geometry. In comparison to traditional ply-based design methods, the multi-ply design method can achieve similar designs with a savings of up to 80 percent.

Fill-to-curve and extend-along-curve transitions benefits:

- Increase design efficiency
- Minimize geometry creation
- Achieve complex ply shapes automatically

Fill-to-curve and extend-along-curve transitions

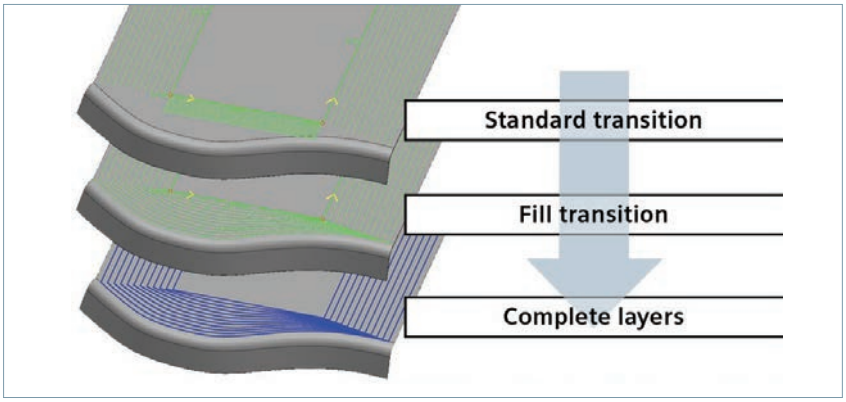
Ply drop-off boundaries for automated design methodologies are based on specifications for drop-off profiles and spacing. However, sometimes determining or achieving the desired shape can be challenging. Exact ply boundary geometry generated by automated design methodologies can now be easily achieved with the fill-to-curve and extend-along-curve transition functionality. The automated generation of transitions that meet the desired shape increases design efficiency. The fill-to-curve transition type and the extend-along-a-curve transition functionality help engineers achieve their desired ply shapes.



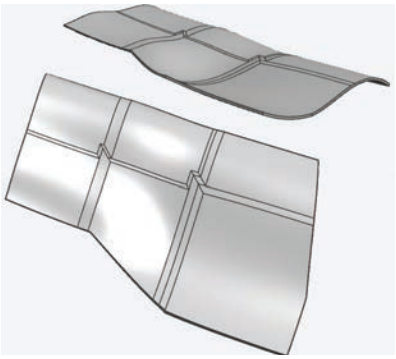
Full body and reinforcement base shapes are defined by the red, magenta and green, and automatically become dropped-off plies with all their boundaries in red (45° plies), blue (0° plies) and yellow (90° plies).

The new fill-to-curve transition type automatically determines the ply drop-offs and spacing based on a zone or base shape and a selected geometric curve or edge. This transition type can even be applied to complex shapes. This was not the case in earlier releases of Fibersim, which did not support the automatic generation of ply drop-offs and spacing. Now by simply defining a curve or edge to any complex shape, the fill can be automatically determined.

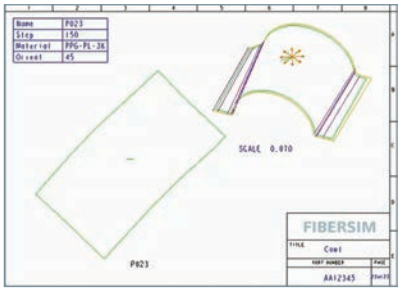
The extend-along-a-curve functionality within existing Fibersim transitions enables



Compared to a standard transition, the fill-to-a-curve transition automatically determines the ply boundaries between the base-ply edge and the edge of the surface before the fillet.



A net part solid generated by the parametric surface offset functionality based on the layer shapes created by a zone-based design.



A ply book drawing generated in Creo shows ply parameters in the tables, its flat pattern, location on the tool and the layup process (orange radial arrows).

an engineer to have the transition guided along a particular path by using a guide curve to obtain the exact ply boundary geometry while maintaining the automation of the transition feature.

Parametric surface offset solid benefits:

- Efficiently create inner mold line representation
- Quickly obtain net solid of the composite part

Parametric surface offset solid

Composite designs are typically created without developing a full 3D geometric representation of every ply. Therefore, creating an inner mold line (IML) surface or a complete solid of a composite part can be difficult and very time consuming. Fibersim parametric surface offset technology creates an IML surface automatically and a structured geometric framework that can be updated even when it is modified. The engineer is made aware of design changes that affect the IML surface so updating is a push-button process.

A final 3D solid part representation for packaging, assemblies, tooling and documentation is often required. You can use the same parametric surface offset functionality in Fibersim 14 to generate a net part solid shape from the composite design, saving days or weeks of effort.

Fibersim for manufacturing throughput and quality

Ply books and ply tables for PTC Creo:

- Automatically generate manufacturing documentation
- Eliminate part-to-part production inconsistency
- Increase production throughput

Ply books and ply tables for PTC Creo

Ply books and ply tables are a requirement for achieving the highest throughput and consistent quality when using manual layup manufacturing methods, and for the first time Fibersim 14 can be used to bring both capabilities to the PTC Creo platform. Without layup guidance, technicians will lay up the same part differently. Laser projections systems alone cannot display the layup process, producing ambiguity.

Fibersim ply books provide automated 2D documentation that ensures that a ply and its layup process are apparent, eliminating errors and ensuring consistent production.

Ply tables provide automated 2D documentation that lists all the plies and the desired properties so that they can be validated with kits or during layup.

Contact
Siemens PLM Software
+1 781 907 9800

www.siemens.com/plm

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