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Fibersim Pro and Fibersim Elite

Streamlining composite product development with specification-driven design

Benefits

- Develop composite products effectively with specification-driven design
- Implement design changes efficiently
- Use composite materials effectively during the design process
- Assess the best combination of product shape, material and process
- Eliminate waste and cost during manufacturing processes

Features

- Define plies and inserts, including up to 150 attributes
- Automate laminate definition and changes with zone, grid, multi-ply or volume-fill approaches
- Automate the generation of the inner mold line
- Extremely accurate producibility simulations that mimic expected manufacturing processes
- Automated manufacturing resolution capabilities

Summary
Advanced composite materials offer significant opportunities for lightweighting, cost reduction, performance enhancement and reduced maintenance. However, the challenge of designing with composites is that the part and the material that make up the part are developed simultaneously. Effectively designing with composites requires that part geometry, material behavior and manufacturing process are understood together. The Fibersim™ portfolio of software for composites engineering includes Fibersim Pro and Fibersim Elite from Siemens Digital Industries Software. These are specialized engineering environments that bring together all the aspects for realizing the successful development and manufacture of composite parts. The open architecture of Fibersim provides a specialized engineering environment for composites that are being developed using NX™ software, CATIA V5 and PTC Creo.

Manual design
Defining composite parts requires the engineer to bring intelligence to surface-, ply- and insert-boundary geometry. Composite designs are data rich, and are often referred to as an inseparable assembly of plies. Each one of those plies can contain up to 150 attributes that must be associated to the geometry.

Fibersim ply-based design ensures that the appropriate attributes consistently deliver that intelligence by using higher level composite object associations, a configurable composite materials database and industry-proven producibility simulations. Plies can be defined one-by-one, in groups or using imported ply lists that automatically link to predefined geometry. Leading companies have used Fibersim to decrease development time by 60 percent as well as reduce overall manual definition errors.

Automated design
Geometry creation for iterative composite design processes is time consuming if done manually. Eliminating the majority of ply- and insert-boundary geometry creation provides an engineer with more time to focus on optimizing the part and making the right material and manufacturing process choices. Automating the design process ensures that changes can be made effortlessly and without error.

Fibersim Pro and Fibersim Elite

Zone- and grid-based design are the trademark Fibersim approaches for panels and other parts that utilize specifications, include material stackups, drop-offs and drop-off profiles to drive geometry creation. Specifications are applied to interdependent regions of the part and Fibersim then solves for the ply shape. Changes during the iterative design process are made to the specifications, which immediately updates the ply shape.

Multi-ply design is a unique Fibersim automated composite design approach that also uses specifications, including material stackups, drop-offs and drop-off profiles to drive geometry creation. However, unlike traditional zone- or grid-based design approaches, the engineer can place independent reinforcement regions on top of other regions, eliminating zone or grid redefinition. Also, unlike a ply-based approach, the design is updatable without reworking the geometry and associated ply definitions. Traditional and multi-ply methods used in combination can deliver an unequalled level of flexibility and efficiency. Customers using these design approaches have experienced up to an 80 percent increase in design efficiency.

Volume fill is also a unique Fibersim automated composite design approach for thick parts that utilize two surfaces and the thickness of materials to drive the generation of ply boundaries. However, unlike solid slicing approaches, volume fill generates the draped surfaces for larger plies over smaller ones and is updatable during material or stackup order changes. Resulting producibility simulations are done on these surfaces, providing the required accuracy needed to properly fill the part volume. Customers using volume fill have experienced a 75 percent increase in design efficiency.

Final part shape and tooling
The completion of a composite design requires the development of the IML. The IML is required for packaging, mating components and tooling. Manually creating the IML to achieve a final part shape definition requires an engineer to determine constant gauge region thicknesses and ramps between the regions. IML development is arduous and error prone and takes weeks of work. Improperly created inner mold lines can lead to significant problems downstream in the development process. Design changes in thickness, geometry or ply shape require additional weeks of rework.

Fibersim parametric surface offset (PSO) technology automates IML generation and any changes by using the results from specification-driven designs (zone, grid and multi-ply) as the basis. Uniquely, any part of the PSO can be manually modified and will remain updatable with the automated portion. Customers have experienced 75 percent or greater reductions in IML creation time by using Fibersim PSO technology.

Producibility simulation
Alignment of reinforcement fibers with load paths is often critical to part performance, enabling the user to avoid overbuild and in-field failures. Therefore, in the context of part geometries and manufacturing processes, understanding material behavior is critical to developing composite parts that meet or exceed their economic and functional requirements. Fibersim simulation methods for hand layup and automated manufacturing processes are industry proven to provide the most accurate results. The accuracy of Fibersim simulations has provided customers with up to a 60 percent reduction in scrap rates. Fibersim simulation methods are modifiable to ensure that the layup process is simulated in accordance with expected manufacturing layup practice.

Manufacturing resolution
Deformation of materials is not always avoidable due to situations such as part geometries resulting from packaging, material lock angles or manufacturing process limitations. Fibersim provides capabilities to both dart and splice plies so that the flat pattern generated from the producibility simulation will include the manufacturing resolution and be usable during the manufacturing process.

Automated manufacturing poses challenges in terms of machine limitations. Fibersim includes a configurable machine database and the capability to determine course layup challenges so they can be addressed before path planning. Whether using hand layup or automated manufacturing process designs that do not incorporate the manufacturing resolution will increase weight, scrapped material, ultimately decreasing production throughput.

Data management
During design, plies, inserts and specifications, along with their vast set of attributes, need to be managed and easily accessible to facilitate an efficient design process. Fibersim supports the ease of managing data with capabilities such as persistent filtering by laminate in multi-laminate parts, and sorting or grouping by attributes, such as geometry for ease of identifying objects. Integrating the Fibersim specialized engineering environment with Teamcenter® software ensures composite parts and associated manufacturing outputs are revision controlled and accessible throughout the enterprise, maximizing productivity and improving product quality.

Supported CAD platforms

CAD	Fibersim Pro	Fibersim Elite
NX	X	X
CATIA	X	X
Creo	X	

Supported design methodologies

Design methods	Fibersim Pro	Fibersim Elite
Ply (manual)	X	X
Multi-ply (automated)	X	X
Zone/grid (automated)		X
Volume fill (automated)		X

Simulation and IML creation capabilities

Capabilities	Fibersim Pro	Fibersim Elite
Hand layup simulation	X	X
Fiber steering simulation	X	X
Fiber placement and tape laying course challenges	X	X
Forming ply slip	X	X
Splicing/ darting	X	X
Flat pattern assessment (3D)	X	X
Parametric surface offset	X	X

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