Composite materials are formed from the combination of two or more layered materials, each having very different properties. Composite materials have become a standard for manufacturing products that are both light and strong. Additionally, composites provide much flexibility, enabling products with complex shapes, such as boat hulls or surfboards, to be manufactured.

Among the many challenges of designing products from composites is defining the specifications of each layer that constitutes the composite material. To engineer layered composites, a designer must find the best combination of lamina, including the number of layers involved as well as the thickness and relative orientation of each layer. As with homogeneous materials, stresses, deformations and other performance indicators will help determine a product’s performance under actual working conditions. A range of failure criteria, from simple to more advanced formulations, is usually used to study how the layer material and their orientations affect the design of the product.

ANSYS® Composite PrepPost software provides all the necessary functionality for the analysis of layered composite structures. An intuitive interface efficiently defines materials, plies and stacking sequences; it also offers a wide choice of state-of-the-art failure criteria. ANSYS solvers provide the foundation for accurate results, while additional computations for the failure criteria are performed within the ANSYS Composite PrepPost application.

The post-processing capabilities of ANSYS Composite PrepPost software allow an in-depth investigation of the product’s performance under actual working conditions. Layer orientation and layer-wise failure criteria analysis on a complex hull shape.

Product Features

**Unique Material Definition Functionality, Tailored for Modeling Layered Composite Structures**
- Basic materials with engineering constants
- Uniaxial fabrics with vendor-specific data
- Multiaxial fabrics with vendor-specific data
- Standard laminate templates

**Coordinate Systems**
- Cartesian, cylindrical, spherical

**Oriented Element-Set Concept**
- Definition of material application direction independent of shell normal
- Definition of material 0° direction
- Overlapping multiple oriented element sets
- Unique possibility of easy asymmetric laminate definition
- No need of ply subdivision

**Surface and 3-D Modeling**
- Generation of layered solid composite models from layered shell models
- Layer-wise post-processing of layered solid and layered shell models
- CAD geometry import (STEP, IGES):
  - Modeling of core plies with variable thickness
  - Cut-off rules

**Draping and Flat-Wrap Functionality**
- Analysis of draping, write and load draping data
- Analysis of fiber-angle correction processing
- Flat-wrap analysis and export of plies with distortion
Product Features

Comprehensive Composite Failure Analysis Capabilities

- Inverse reserve factors (IRF), reserve factors (RF) and margin of safety (MOS) for composite failure criteria at all integration points of all layers
- Arbitrary combinations of failure criteria
  - Max. strain, max. stress, Tsai–Wu, Tsai–Hill, Hashin, LaRC, Cuntze
  - Puck 2-D and 3-D for UD and weave materials
  - Core failure and face sheet wrinkling for sandwich structures
- Multiple load case consideration
  - Four result values per in-plane data point
  - Maximum IRF of all criteria of all layers
  - Active failure mode
  - Layer index with highest IRF
  - Critical load case
- Simple definition, configuration and combination of desired composite failure criteria
- Unique method to evaluate interlaminar normal 3-D stress in curved laminates based on shell elements
- Element sampling enables ply-based strain, stress and IRF visualization
- Result visualization for each ply of the laminate
- Text plot highlights critical failure mode, layers and load case
- Sensors for the evaluation of material quantity and cost
- Python™ scripting interface (for user-specific failure criteria)

Ply-Book Generation

- Generation of individually formatted ply books in restructured text format
- Can be exported in various formats (*.html, *.pdf, *.odt, etc.)

Scripting and Automation

- Python scripting interface to automate model definition

The ANSYS Advantage

With the unequalled depth and unparalleled breadth of engineering simulation solutions, companies are transforming their leading-edge design concepts into innovative products from ANSYS and processes that work. Today, almost all of the top 100 industrial companies on the “FORTUNE Global 500” invest in engineering simulation as a key strategy to win in a globally competitive environment. They choose ANSYS as their simulation partner, deploying the world’s most comprehensive multiphysics solutions to solve their complex engineering challenges. The engineered scalability of solutions from ANSYS delivers the flexibility customers need, within an architecture that is adaptable to the processes and design systems of their choice. No wonder the world’s most successful companies turn to ANSYS — with a track record of 40 years as the industry leader — for the best in engineering simulation.