



Why Finite Element Analysis for Composites

NEi Software has Finite Element Analysis (FEA) software tools that allow composite product and design engineers to examine the structural, dynamic, and thermal aspects of their designs with detailed graphical visualization of data and results. The insight gained by such analysis allows designers to easily try alternate approaches, optimize their designs, improve quality, reduce design cycle time, and save time and money on prototypes and first articles. NEi Nastran's value has been proven by engineers in a wide variety of industries including aerospace, military, automotive, maritime, sports, and consumer products. Formula 1 race cars, America's Cup yachts, Tour de France bicycles and entrepreneurial commercial spacecraft are just a few examples of highly advanced projects that rely on NEi Nastran.

Features to Look for in FEA Software for Composite Analysis

Composite materials analysis imposes a number of requirements that are significantly different when compared to isotropic materials. FEA software used for composite analysis should be designed with certain features to make it easy to use while providing results that are practical and truly valuable for application to real world problems. NEi Nastran fills this need with a number of features in model creation, meshing, and post-processing.

NEi Nastran's Unique Composite Analysis Features

Easy definition of material properties. Clear, easy input of strength and stiffness terms with access to material libraries.

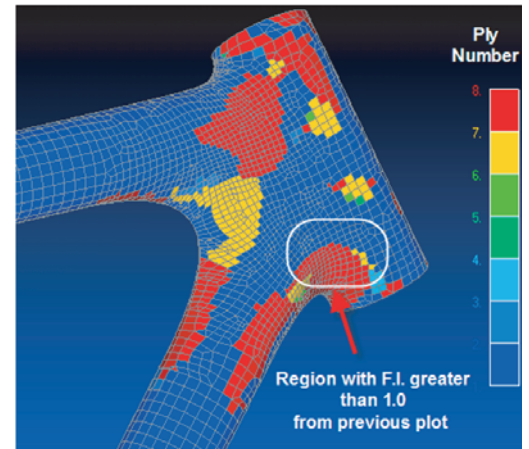
Definition of ply lay-up. Stacking sequences can be easily entered and modified, and symmetry can be used to reduce entries.

Easy orientation definition. Curved surfaces can complicate the orientation of fibers. NEi Nastran can project a cylindrical or spherical coordinate system onto a structure to get a good representation of ply orientation.

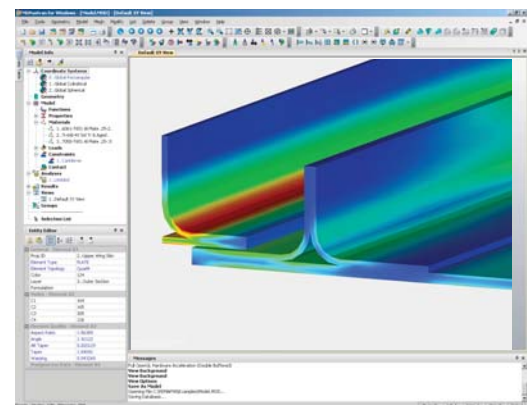
2D and 3D composites. NEi Nastran supports laminate properties for both 2D shell elements and 3D layered solid elements.

Outer mold line representation. Ensures mesh congruence during modeling process.

Post-processing visualizations that pinpoint problems at the ply level. Enormous amounts of data can be involved in multi lay-up and multi ply structures. NEi Nastran provides a logical path from stress analysis of a structure to failure index results that can isolate problems to specific plies.



Ply by ply results for composites



Example of 3D composites capability in NEi Nastran

FEA for Composites

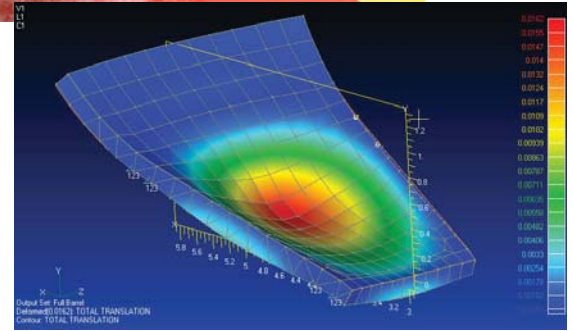
NEi Nastran's Unique Composite Analysis Features (continued)

Failure indices and strength ratios. NEi Nastran supports all the major composite failure analysis indices including the most modern forms of Puck and NASA Langley LaRC02. Plus strength ratios are available for easy linear scaling and qualitative analysis.

Sandwich material face sheet stability indices. NEi Nastran can predict the different failure modes of a composite sandwich material face sheet such as wrinkling, crimping, and dimpling.

Advanced Analysis Capabilities. NEi Nastran has the ability to perform Progressive Ply Failure Analysis (PPFA™) for advanced analysis scenarios at a fraction of the cost of other composite analysis tools. NEi Nastran also allows you to model temperature dependent composite materials. This feature saves time by not requiring analysts to define separate properties for each temperature dependent element across a thermal gradient.

Simple Material Property and Layup Editors. Both Femap® and NEi Fusion modelers allow easy composite ply definition while providing advanced features for material property entry.



Define Material - 3D ORTHOTROPIC

ID: 120 Title: 3D ORTHOTROPIC Color: 55 Layer: 1

General Function References Nonlinear Creep Electrical/Optical Phase

Stiffness (E) Shear (G) Poisson Ratio (nu)

1	10000000	12	4000000	12	0.2
2	1000000	23	2000000	23	0
3	100000	13	2000000	13	0

Limit Stress: Tension: 40000, Compression: 80000, Shear: 5000

Specific Heat, Cp: 0, Mass Density: 0, Damping, 2C/Co: 0, Reference Temp: 70

Layup Editor

Total Thickness = 0.25

Ply ID	Global Ply	Material	Thickness	Angle
5		120.3D ORTHOTROPIC	0.02	0
4		120.3D ORTHOTROPIC	0.05	60
3		120.3D ORTHOTROPIC	0.06	90
2		120.3D ORTHOTROPIC	0.07	45
1		120.3D ORTHOTROPIC	0.05	0

Femap® Material Property and Layup Editors

Laminate

Ply ID	Global Ply	Material	Thickness	Angle
5		120.3D ORTHOTROPIC	0.02	0
4		120.3D ORTHOTROPIC	0.05	60
3		120.3D ORTHOTROPIC	0.06	90
2		120.3D ORTHOTROPIC	0.07	45
1		120.3D ORTHOTROPIC	0.05	0

Check All N.S. Mass/Area (lb/s²/in³):

Failure Theory: NASA LaRC Ref. Temperature (F):

Bottom Fiber Distance (in):

Allowable Bond Shear Stress (psi):

Damping Coeff.:

Total Thickness (in):

NEi Fusion™ Material Property and Layup Editors

3D CAD models. Femap®, NEi Fusion™ and NEi Works™ can import models from all major CAD systems.

