

ANSYS/Professional™

Design Studies

- Design sensitivity
- Optimization
- ANSYS parametric design language (APDL)
 - Define geometry in terms of variables
 - Trigonometric functions
 - Do-loop feature
 - If-then-else constructs
 - Array parameters
 - Array parameter operations
 - Macros

Performance Simulation

- Structural
 - Dynamic
 - Transient, natural frequency, harmonic response, response spectrum
 - Buckling
 - Linear
 - Topological optimization
- Thermal
 - Transient
 - Conduction
 - Convection
 - Radiation
 - Phase change via enthalpy
- Thermal/electric

Non-linear Capabilities

- Structural
 - Geometric
 - Large deflection (for beams and shells)
 - Stress stiffening (for beams, shells and solids)
- Thermal
 - Temperature-dependent properties, Phase change via enthalpy, radiation view factor matrix

Geometric Modeling

- NURBS-based solid modeling
- Primitives and Boolean operations
- CAD geometry import, cleanup and defeaturing tools

Mechanical Toolbar GUI

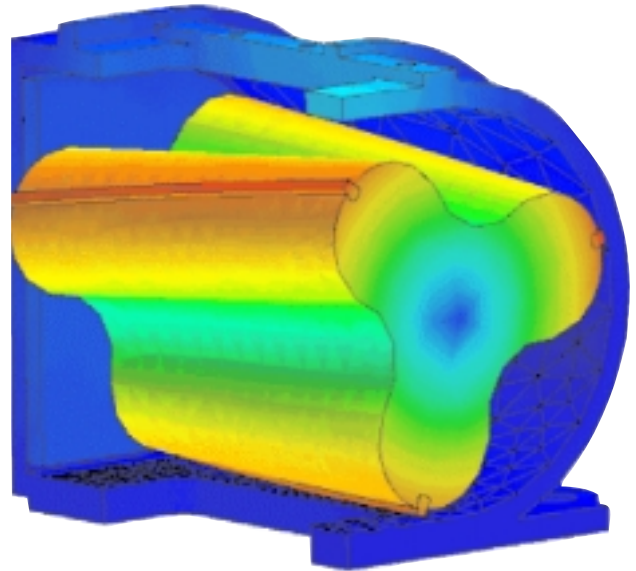
- Intuitive
- Windows® look and feel
- Cascading pull-down menus
- Dialog boxes
- Customizable tool bar
- Online documentation and hypertext linked HELP
- Supplemental HTML help

Element Library

- Structural
 - Links
 - Beams
 - 2-D and 3-D shells and solids
 - Composite layered shells and solids
 - P-element shells and solids
 - Matrix stiffness
 - Mass elements
 - Contact elements
 - Surface-to-surface, node-to-node
- Thermal
 - Links
 - Conduction, convection, radiation
 - Surface elements for convection
 - 2-D and 3-D shells and solids
 - Radiation matrix (substructure)

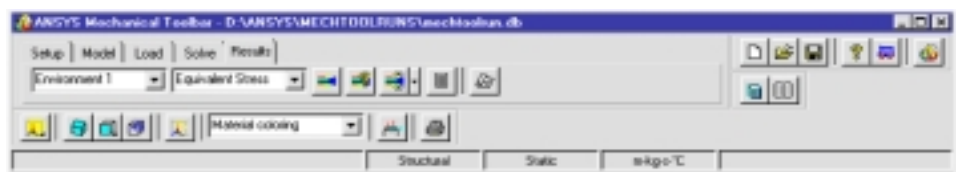
Implementing a completely virtual product development system saves money and moves products to market faster. But many companies don't implement such a system because of the high cost of CAE software. Fortunately, there is a low-cost alternative that gives even beginning users access to a considerable amount of simulation power.

ANSYS/Professional™ is an inexpensive, easy-to-use program for structural and thermal analysis projects. Containing the power of the industry's leading simulation technology, ANSYS/Professional gives users high-level simulation capability without the need for high-level expertise. It comes complete with a full contingent of linear elements, significant non-linearities, the ability to solve complex assemblies—including shell-to-solid—and the most requested set of solvers.



Structural analysis of Roots type blower found in automotive engines performed using ANSYS/Professional.

ANSYS/Professional features a series of GUIs that enable users to deploy analysis power at their own pace. First-time users can access ANSYS/Professional's Mechanical Toolbar GUI (shown below) and easily proceed through the simulation step-by-step. As they become more proficient and begin to require additional simulation capability, the user can move up to the standard ANSYS GUI. For the most customizable simulation capability, the ANSYS parametric design language (APDL) GUI is available.



ANSYS/Professional's easy-to-use Mechanical Toolbar interface gives the user access to considerable simulation power.



ANSYS®

ANSYS/Professional 6 New Features

Model Definition/Meshing

- ▶ Automatic finite element mesh generation
 - Quadrilateral elements, triangle elements, mixed quad/triangle elements, mapped brick elements, tetrahedral elements
- ▶ Adaptive meshing
- ▶ Mapped meshing
 - Surface sweep for volumes
- ▶ Structural p- and h-element meshing
- ▶ Error estimation
- ▶ Solid-, surface- or bar-element meshes
- ▶ Specialized 2-D and 3-D meshing
- ▶ Rotate, drag and extrude options to create a 3-D mesh from a 2-D model
- ▶ Mesh density may be automatically selected or user-controlled
- ▶ Automatic 2-D layer meshing

Results Evaluation

- ▶ Vector displays
- ▶ Select and sort listing
- ▶ Load case and transient postprocessing
- ▶ Sensitivity and optimization graphs
- ▶ Smooth or stepped results plots
- ▶ Enhanced interactive view manipulation
- ▶ Contour and legend control
- ▶ Input data and results listing
- ▶ Extensive bar element listing
- ▶ Output to VRML, PostScript, TIFF, HPGL, Windows metafile and Windows enhanced metafile
- ▶ Annotation
- ▶ Scalar and vector calculus operations on a mapped results path, derivatives, integrals, and normal, tangential and position vectors
- ▶ Submodeling
- ▶ Fracture and fatigue calculations

Solution Methods (Solvers)

- ▶ ANSYS/PowerSolver (iterative)
 - Eigenvalue
- ▶ Conventional (frontal)
 - Direct
 - Subspace eigenvalue
 - Reduced eigenvalue
- ▶ Other
 - Incomplete Cholesky conjugate gradient (ICCG)

Platforms

- ▶ Compaq Tru64 UNIX
- ▶ Hewlett-Packard HP-UX
- ▶ IBM RS/6000 AIX
- ▶ Silicon Graphics IRIX
- ▶ Sun Solaris
- ▶ Intel workstations (Windows 2000, Windows NT 4.0, Windows ME, Windows 98, Linux)

Functionality Enhancements

- ▶ 18x series of non-linear material elements now feature birth-and-death functionality, making them a truly comprehensive set of multi-faceted elements.

- ▶ SHELL181, a newly added four-noded composite shell element, features expanded shell-section properties that allow the definition of a laminated shell composite

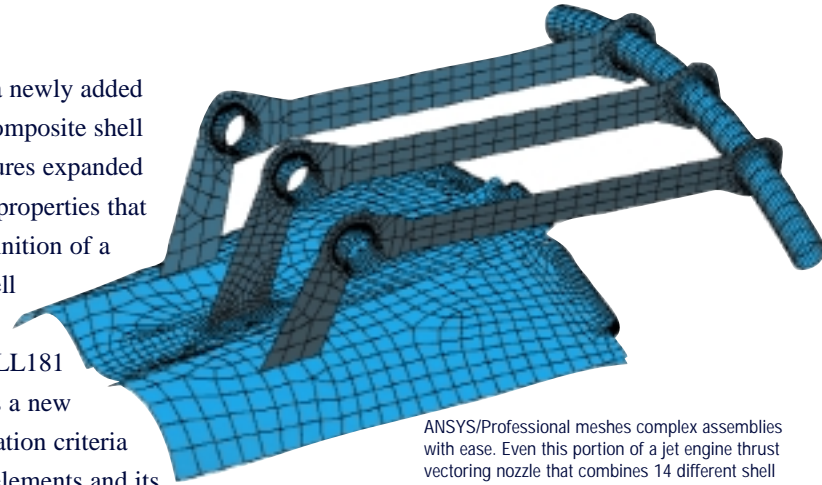
section. SHELL181

fully supports a new

failure calculation criteria

for 2-D/3-D elements and its

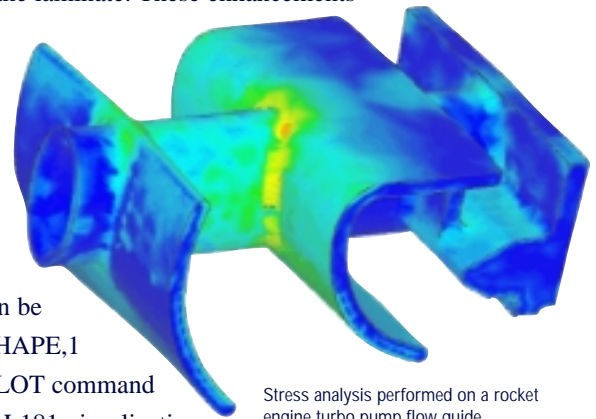
post-processing is consistent with all existing shell capabilities.



ANSYS/Professional meshes complex assemblies with ease. Even this portion of a jet engine thrust vectoring nozzle that combines 14 different shell and solid parts and 64 contact points.

- ▶ New Section Definition dialog box simplifies the definition of SHELL181 layered elements. Enter shell section data (e.g., layer thickness, orientation, material, etc.) in a spreadsheet format, and the box transparently issues the required SECx series of commands.

- ▶ New shell-section capability allows SHELL181 to support the offset of the shell reference plane, tapered shell sections, and an arbitrary number of integration points through the thickness of the laminate. These enhancements—along with the ability to mix different material models within the same laminate—make SHELL181 a powerful tool in analyzing laminated composite structures.



Stress analysis performed on a rocket engine turbo pump flow guide.

- ▶ Layered SHELL181 element can be visualized in 3-D using the /ESHAPE,1 command. Also, the new SEC PLOT command provides an effective 2-D SHELL181 visualization tool. The initial stress capability has been enhanced to accommodate the new SHELL181 layered element. Definition of an initial stress value is possible at every integration point of each SHELL181 layer.