ANSYS® Add-On Modules

ANSYS®

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DesignModeler Features

3-D Parametric Modeling
- Extrude
- Revolve
- Sweep
- Skin/loft
- Surface
- Blend
- Chamfer
- Welds

Primitive Shapes
- Sphere
- Box
- Parallel piped
- Cylinder
- Cone
- Prism
- Pyramid
- Torus
- Rectangular bend

3-D Editing
- Merge/slice bodies
- Surface extraction
- Surface extension
- Join surfaces
- Volume enclosure
- Volume fill
- Face delete
- Named selection
- Symmetry extraction
- Mid-surfacing

3-D Concept Modeling
- Beams from lines/edge
- Plates from lines/sketches
- 11 cross section types
- Parametric cross sections

2-D Sketching
- Drawing tools
- Line modifications
- Dimensioning
- Sketch constraints

Electromagnetics Modeling
- Winding bodies
- Winding tool
- Volume enclosure

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ANSYS® DesignModeler™

Modeling and Geometry Editing Tailored for Simulation

Creating design models is a core part of the product development process and the first step in the simulation process. These models can be of a geometry form representing the actual design detail, or they can be an approximation of the design using simplified components like beams and plates.

Simulation often demands unique modeling capabilities that typical CAD operations do not require. Therefore, these capabilities are either lacking in CAD systems or implemented in a fashion that is not optimum for performing simulation-related functions.

The ANSYS DesignModeler product is an ANSYS® Workbench™ application from ANSYS, Inc. that provides modeling functions unique for simulation that include detailed geometry creation, CAD geometry modification and concept model creation tools.

Detail Geometry Creation

DesignModeler offers geometry creation features like extrude, revolve, sweep, chamfer functions and others to create fully parametric models. These models can be used with any core ANSYS simulation product or with the ANSYS® DesignXplorer™ product for performing design optimization.

CAD Geometry Modification

CAD models are usually intended to accurately represent the exact intent of the final design and often lack additional features required for simulation. The DesignModeler product provides these unique simulation features like splitting surfaces for applying loads, defining welds or creating regions around models that represent “air.”

CAD models also may contain much more detail than the simulation process requires or the detail may not be in the right form. The DesignModeler product enables tasks like CAD feature deletion, surface extraction from a solid body, suppressing parts and merging parts into one body.

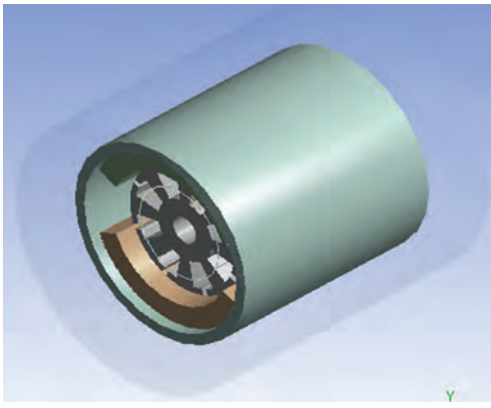
Concept Model Creation

Concept models are used in a product development process prior to any detailed CAD geometry being created. These design approximations, along with simulation results, are extremely useful in making fast product decisions early in the design cycle when product costs can be impacted significantly.

Electromagnetics Modeling Tools

The majority of MCAD systems do not allow users to prepare a solid model for an electromagnetic analysis. The DesignModeler product provides several essential tools for this process.

Enclosure Tool: Used to enclose the bodies of a model in a dielectric material (typically air) required for an Emag analysis. Full or partial models can be included in the enclosure, and symmetry is supported when the enclosure shape is a box or a cylinder. (Up to three symmetry planes can be specified.)



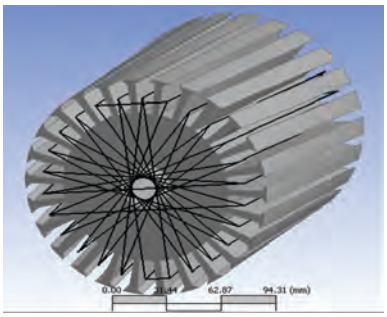
Geometry representing the air around an electric motor armature is created by the Enclosure tool for a later electromagnetic field analysis.

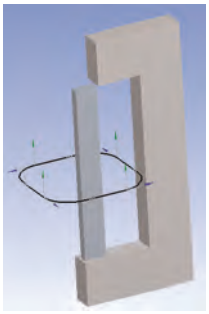
Winding Bodies: Represent wires or wound coils for electromagnetic source excitation. The advantage of these bodies is that they are not 3-D CAD objects, and hence, greatly simplify modeling and meshing of current carrying structures. Upon "attach to simulation," winding bodies are assigned as Conductor bodies.

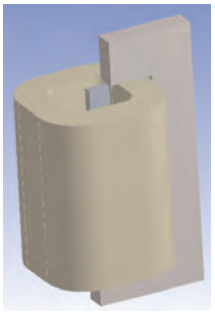
Winding Tool: Creates complex coils for motor windings. The winding tool uses a worksheet table format to drive the creation of multiple connected winding bodies. The winding tool also can import/export an MS Excel spreadsheet describing the coil.

Geometry Exchange

The DesignModeler product can read geometry from any ANSYS Workbench supported CAD system. Parametrically supported CAD systems also will be parametrically associative in DesignModeler. In addition to importing data, the DesignModeler product can export data as Parasolid®, IGES, STEP and the ANSYS ANF geometry format.







ANSYS DesignXplorer Family

Design for Six Sigma (DFSS) designs quality into a product. By assessing the variations that a product experiences during manufacture and use, it is possible to make a product that performs its intended function regardless of these variations. Such a product is "robust," and therefore, Design For Six Sigma is sometimes called Robust Design.

Design for Six Sigma is an analysis technique to determine the extent to which uncertainties in the model affect the results of an analysis. Based on a probabilistic characterization, Design for Six Sigma enables users to quantify the quality of a product by addressing issues such as minimizing warranty costs and assessing the reliability of the product. DFSS goes one step further than a probabilistic characterization by allowing users to optimize design variables to achieve a particular probabilistic result such as Six Sigma, which, including long-term effects, is 3.4 failures in one million parts!

Six Sigma initiatives try to optimize the manufacturing process such that it automatically produces parts conforming to Six Sigma quality. In contrast, DFSS optimizes the design itself such that the part conforms to Six Sigma quality even with variations in manufacturing. For Design for Six Sigma and Robust Design, quality is an explicit goal of the optimization.

The ANSYS® DesignXplorer VT™ and DesignXplorer solutions provide users with the ability to create a Robust Design by allowing the user to define both Design Variables and Uncertainty Variables and then optimize a set of reliability goals for quantities such as fatigue life, stress or deflection. For more information, please see the Design For Six Sigma Solution brochure.

ANSYS DesignXplorer VT

Look beyond traditional aspects of simulation and analyze entire systems with the ANSYS DesignXplorer VT software, a Variational Technology solution that gives users a broader view of design concepts providing complete FEA results for every design point. Depending on the analysis problem, Variational Technology can provide acceleration factors between 10 and several thousand. With Variational Technology, users can approach product design decisions much more efficiently.

Using ANSYS® Variational Technology™ to automatically calculate the entire design envelope within a single finite element solution, DesignXplorer VT software allows users to perform quick and accurate what-if scenarios to periodically test design ideas. A traditional Design of Experiments (DOE) approach requires many solutions to capture the behavioral changes due to parameter variations. For discrete parameters, the practical limit using traditional methods is about 10 discrete parameters, but the DesignXplorer VT product handles more than 100 discrete parameters even when combined with other parameter types.

The DesignXplorer VT solution allows designers and analysts to make intelligent design decisions given multiple competing objectives. These variations can include geometric CAD parameters, the ANSYS® ParaMesh™ product parameters, element properties, material properties and load variations. The DesignXplorer VT solution's proprietary Variational Technology offers the capacity to study, quantify and graph the structural analysis response to alternative design parameters.

DesignXplorer VT addresses many kinds of parameters:

- Geometric variations (CAD or ParaMesh)
- Discrete variations (active or inactive status of spot welds, stiffening ribs, bolts, etc.)
- Element property variations (shell or layer thickness, spring stiffness, point mass)
- Material variations (engineered plastics, composites, metals)
- Load variations (inertia and surface structural and thermal loads)

ANSYS DesignXplorer

DesignXplorer, which is based on Design of Experiments (DOE), works from within the ANSYS Workbench interface to perform DOE analyses of any ANSYS Workbench simulation, including those with CAD parameters. Although it requires more analyses to be performed and is typically slower than Variational Technology, DOE is not limited in the types of analyses that it can be used with. In fact, DesignXplorer software can be used with APDL-based files, with or without ParaMesh parameters, to perform DOE on existing or new ANSYS analyses.

ANSYS® Frequency Sweep VT™

The ANSYS Frequency Sweep VT Module is a fast frequency sweep tool for harmonic structural analyses and high-frequency electromagnetic analyses. It is available as an add-on module for the ANSYS® Multiphysics,™ ANSYS® Mechanical™ or ANSYS® Structural™ products.

The ANSYS Frequency Sweep VT Module uses advanced Variational Technology (VT) developed by the development group at CADOE, a subsidiary of ANSYS, Inc. For electromagnetics, the technology extracts an S-parameter sweep extremely efficiently using only one finite element solution. For structural analysis, the technology performs a full harmonic sweep, even with frequency dependent material properties, from one finite element solution. The technology is based on a Taylor series expansion of the single solution.

Parallel Computing

Generate Results Much More Quickly

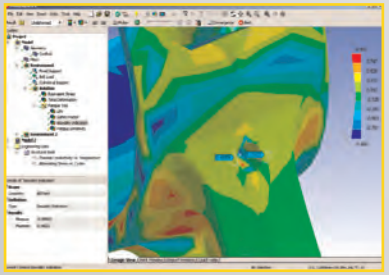
Time is Money! At ANSYS, we understand how much time means to you and that multiprocessing is one means to reduce analysis time. Multiprocessing computer environments (consisting of multi-processor servers or networked workstations or clusters) may be employed to generate simulation results much more quickly. The Parallel Performance for ANSYS add-on module facilitates this highly effective means of operation.

Parallel Performance for ANSYS is ready today for both 32-bit and 64-bit systems. Leveraging your existing investment in 32-bit hardware, Parallel Performance for ANSYS can reduce the solution time due to improved scalability as well as increasing the maximum problem size that can be solved. By utilizing an efficient memory scheme available for tetrahedral elements (which are typical when working with complex CAD solid models that are automatically meshed), more than 10 million Degrees of Freedom can be solved on Intel IA32 Linux machines.

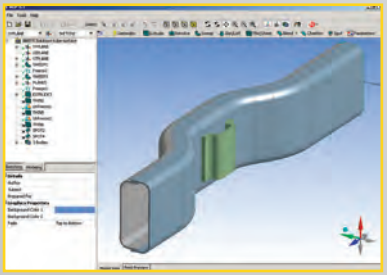
The ANSYS Workbench

The ANSYS Workbench interface represents the next step in the continuing evolution of the ANSYS scalable solution. First introduced in the ANSYS® DesignSpace® 6.0 software, this GUI offers users more intuitive simulation controls.

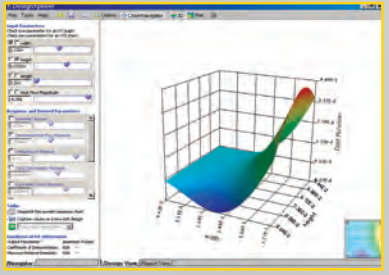
Fatigue: The ANSYS® Fatigue Module™ adds the capability to simulate performance under anticipated cyclic loading conditions over a product's anticipated life span. Incorporating both Stress Life and Strain Life analyses with a variety of mean stress correction methods, including Morrow, Smith-Weston-Topper (SWT) and no mean effects, the Fatigue Module provides contour plots of fatigue life, damage, factor of safety and stress biaxiality. Additional results include rainflow matrix, dam-age matrix, fatigue sensitivity and hysteresis.



DesignModeler: Aids in preparing CAD geometry for simulation. Provides users with a solution for implementing analysis-led design rather than CAD-led design.



DesignXplorer: This module adds advanced parametric control to permit study of the simulation response to proposed modifications. The module includes the ability to quantify and graph results.



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Parallel Computing Features

Memory Architectures

Shared Memory

In a shared memory environment, a single shared memory address space is accessible by all processors. Therefore, each CPU "shares" the memory with the others. A common example of a shared memory system would be an IA32 Windows machine with two processors. Both processors share the same main memory space through a common bus architecture.

Distributed Memory

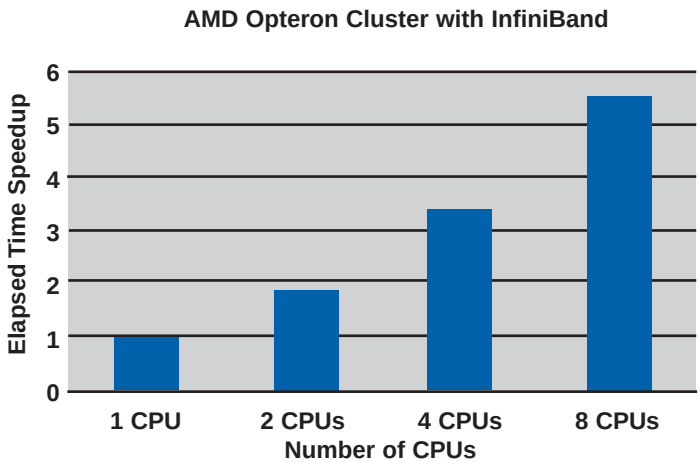
In a distributed memory environment, each CPU or computing node has its own memory address space which is not shared by other CPUs or computing nodes. Communication between machines is by MPI (Message Passing Interface) on the network. A common example of a distributed memory system would be any collection of desktop workstations linked by a network. When the collection of linked processors is dedicated to being a compute engine and is not used for everyday tasks such as email or browsing, it is called a cluster.

Mixed Memory

Mixed memory indicates that the cluster is using a combination of both shared and distributed memory. A common example of a mixed memory system would be a cluster of IA64 CPUs with two CPUs in each physical box sharing that memory, but with a number of these units connected to each other by a network. The PCG, JCG and DSPARSE solvers all support both shared memory and distributed memory by treating the shared memory as if it were distributed memory.

Allowing you to expand beyond the limits of 32-bit computing, Parallel Performance for ANSYS supports a wide variety of 64-bit systems. Combining the PCG solver with the memory-saving option mentioned above allows for the solution of very large static analyses with more than 100 million degrees of freedom! Such models might be encountered when solving large complex assemblies or analyses needing high results accuracy with widely varying load cases, such as those involving fatigue calculations.

With Distributed ANSYS, part of the Parallel Performance for ANSYS module, the entire solution phase runs in parallel, including the stiffness matrix generation, linear equation solving and results calculations. Because each of the three main parts of the overall solution are running in parallel, the wall clock time is significantly reduced. Additionally, the memory required is distributed over multiple systems. This memory-distribution method allows you to solve very large problems on a cluster of machines with limited memory. With multiple processors, you can see significant speedup in the time it takes to run your analysis for both linear and nonlinear analyses



Parallel Performance for ANSYS supports the following analysis types:

- Static linear or nonlinear structural analyses
- Full transient structural analyses
- Static thermal analyses
- Full transient thermal analysis
- Low-frequency electromagnetics

This add-on module features three solvers that permit engineers to exploit inexpensive cluster computer systems using distributed parallel processing and a fourth shared memory parallel solver which offers improved iterative solver performance for many difficult large and complex engineering problems.

Parallel Performance for ANSYS contains the following solvers:

- Pre-conditioned Conjugate Gradient (PCG) (both shared memory or distributed memory)
- Jacobi Conjugate Gradient (JCG) (both shared memory or distributed memory)
- Distributed Sparse (DSPARSE) (both shared memory or distributed memory)
- Algebraic Multigrid (AMG) (shared memory only)

Product Features

Solvers
- Pre-conditioned Conjugate Gradient (PCG)
- Jacobi Conjugate Gradient (JCG)
- Distributed Sparse (DSPARSE)
- Algebraic Multigrid (AMG)

Multiprocessing Computer Environments
- 64-bit Linux clusters
- 32-bit Linux clusters
- UNIX servers
- Networked workstations

Memory Architectures Supported
- Shared memory
- Distributed memory
- Mixed memory

Analysis Types
- Linear structural
- Nonlinear structural
- Full transient structural
- Steady-state thermal
- Transient thermal

Distributed ANSYS supports the following interconnects:
- InfiniBand® (recommended)
- Myrinet® (recommended)
- Gigabit Ethernet
- Ethernet (not recommended)

Find out how the Parallel Performance for ANSYS module can expedite your analyses and make your company more competitive. Visit www.ansys.com for more information.

Drop Test

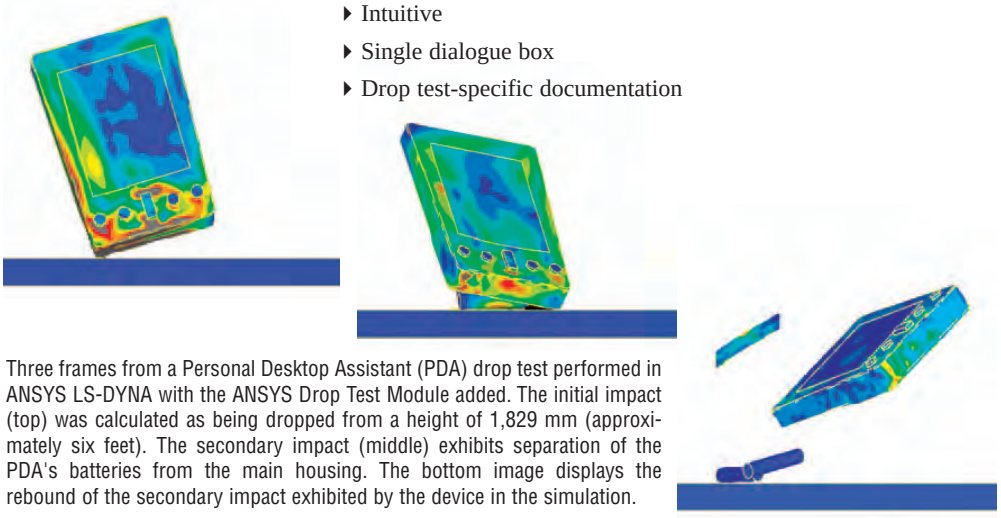
Product drop tests present users with unique parameters for simulation and analysis. The ANSYS® Drop Test™ Module further enhances an ANSYS® LS-DYNA™ license by adding a complement of loads and conditions tailored specifically for such analyses.

Simulation Applications
- Consumer electronics
- Household appliances
- Children's toys
- Lawn and garden equipment
- Power tools
- Sporting goods
- Shipping containers and contents

Loads and Conditions
- Automatic target surface generation
  - Angle of incline
- Initial velocities
  - Translational
  - Angular
- Frictional effects
- Drop heights
- Gravity

User Interface
- Intuitive
- Single dialogue box
- Drop test-specific documentation

Results Evaluation
- Animation output
- Stress
- Deflection
- Strain
- Motion
- Windows AVI format output
- Time history graphs
- Displacement vs. time
- Velocity
- Acceleration



Three frames from a Personal Desktop Assistant (PDA) drop test performed in ANSYS LS-DYNA with the ANSYS Drop Test Module added. The initial impact (top) was calculated as being dropped from a height of 1,829 mm (approximately six feet). The secondary impact (middle) exhibits separation of the PDA's batteries from the main housing. The bottom image displays the rebound of the secondary impact exhibited by the device in the simulation.

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