Assembly Set

capabilities for assembly, design, and evaluation

I-DEAS® Master Assembly™

I-DEAS Master Assembly software allows you to work in a multi-user environment to lay out, design, and manage large mechanical assemblies. It shortens design time and improves design quality by simplifying packaging and interference studies. I-DEAS Master Assembly facilitates a disciplined, "top-down" design approach. It helps you create a logical product structure for products which can have hundreds of parts and many levels of design hierarchy. This allows designs to begin with little or no geometry and grow into a complete "master assembly" database to represent the detailed design efforts of the entire development team.

Model Large Assemblies

I-DEAS software provides a comprehensive set of interactive tools for creating and manipulating large mechanical assemblies. Parts are positioned relative to other parts using intuitive constraints and dimensions which define design intent. Users can dimension and constrain parts relative to one another with natural and intuitive methods that closely represent the physical assembly process. Design changes to one part ripple through the entire assembly dynamically updating part and subassembly positions.

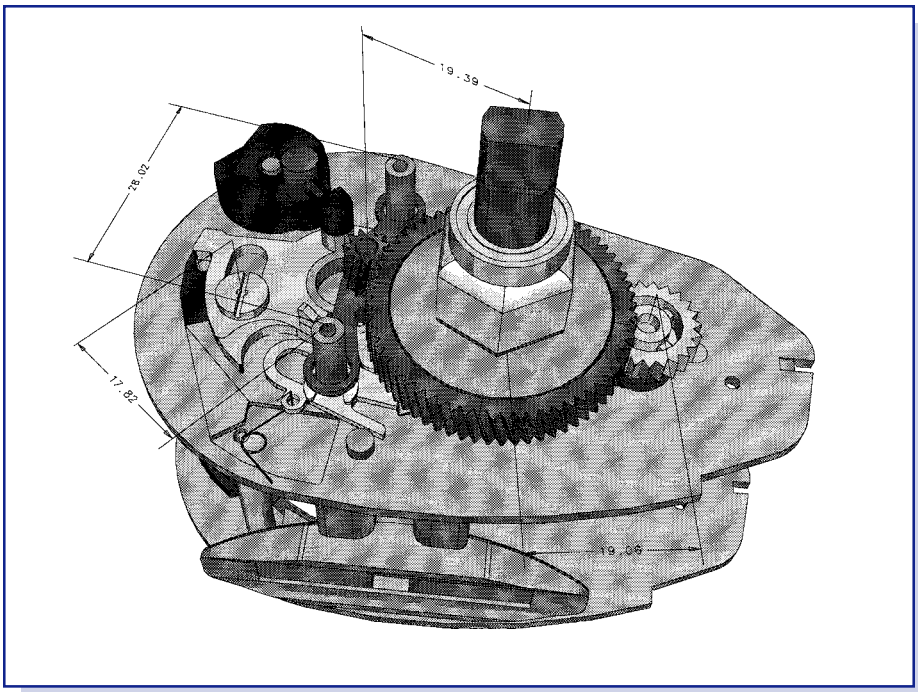
I-DEAS assembly modeling features include:

•Large model size, unlimited number of parts, and hierarchy levels allow you to create a complete electronic product mock-up.

•Flexible methods for part and assembly orientation:

- •Help you modify the orientation of parts in subassemblies.
- •Reflect changes in all or selected instances of the assembly.

•Ability to create a pattern of assembly instances associated to a pattern within a part. For example, a bolt, washer and nut tied to a bolt-hole pattern. The number and positions of the instances will automatically update with changes to the hole pattern.



I-DEAS Master Assembly software allows you to create a complete electronic mock-up of your product design. Intuitive positioning commands and interpart relationships allow you to capture design intent and make design configuration changes easily.

Pruning broadens the I-DEAS toolkit for managing large assemblies. By reducing or eliminating the data moving across the network, performance is increased and model file size is reduced. Assembly integrators can combine and manipulate large product structures without retrieving unnecessary geometry data.

•Tools to retrieve and manipulate product structure without waiting to retrieve all of the associated parts from a library.

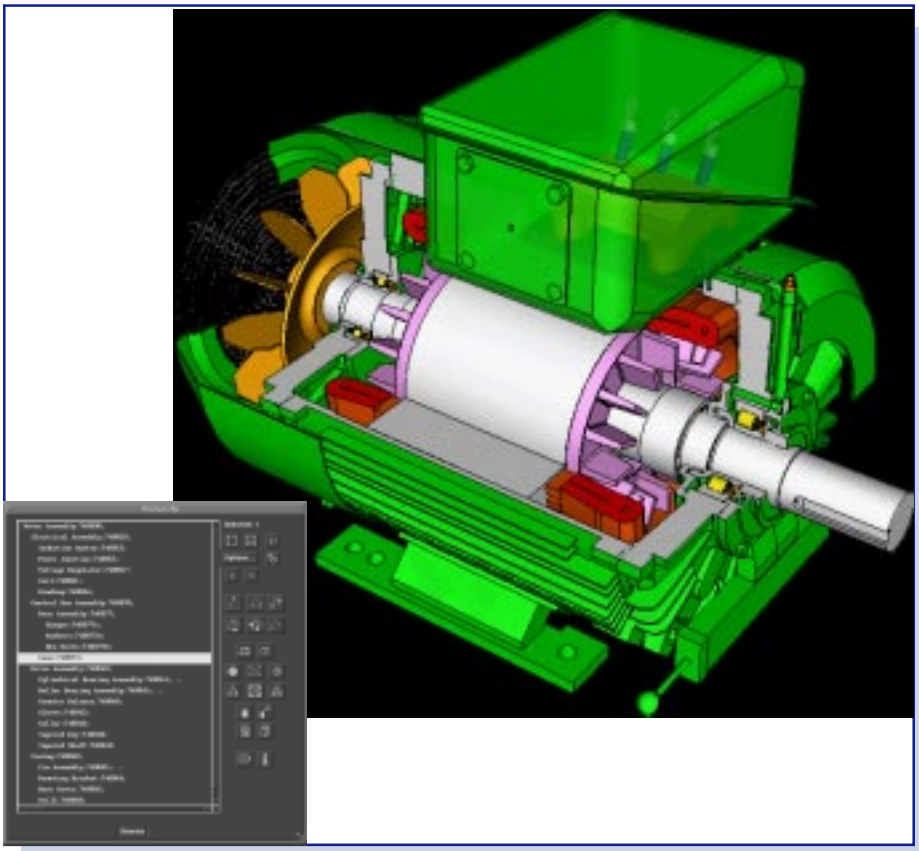
- •Model an individual part in the context of a large assembly.
- •Build overall product structures or Bills of Material (BOM) without any parts.
- •Check fit and function of one or two components that you are responsible for in the context of the entire product structure.
- •Reference a number of components from a variety of assemblies to preclude interference problems.
- •Get the components you need, with the same orientations they have within the context of the assembly that captures the product's design intent.
- •Retrieve only those parts within a specified distance of a selected part or assembly.
- •Avoid getting the components that you do not need.

You can also store prune settings with the assembly to facilitate yourself and others to return to the same subset of parts (working layout).

•For better, fast redisplays, I-DEAS uses "Level of Detail" (LOD) technology. I-DEAS stores LOD with the model file. The first time you display a part, an LOD is generated. Thereafter, performance increases significantly.
•"One Stop Shopping" refers to the ability to build or change a structure, change attributes, prune an assembly, etc., all from one form: the Hierarchy form. You can, for example, pick all of a particular part and modify all instances of it using only this form.

Top-Down Design in a Team Environment

With I-DEAS, design teams can work in a "top-down-to-bottom-up" manner. The lead designer can lay out and plan the assembly and create a product structure for the entire project team. The product structure is associative to assembly geometry and remains accessible to the project team. The assembly design and layout can be started before parts are designed. Outline geometry or spatial envelopes for a subassembly or part can be defined and included in the hierarchy. As you develop more detailed designs of parts or subassemblies, these designs are included in the assembly to replace the spatial envelopes. The design grows in complexity while maintaining the top-down spatial constraints defined at the outset. Throughout the design process, multiple users can access the assembly design using the standard library and data management capabilities of I-DEAS software. This provides a disciplined design check-out and referencing system which allows multiple users to access the latest, most up-to-date design revision. This assures that changes don't occur at the same time, and notifies users of part or subassembly design changes. Changes are communicated to other product assemblies that use them. As a result, the entire team remains up-to-date, and productivity is improved. This approach is aided by the following modeling features of I-DEAS Master Assembly software:



Your "top-down" design can start with a product structure–before geometry is created. Flexible forms-based hierarchy management tools allow you to easily create and modify the product structure. As a result, the design can grow in detail as individual team members incorporate part designs into the product structure. All team members can share design data and remain up-to-date with design changes.

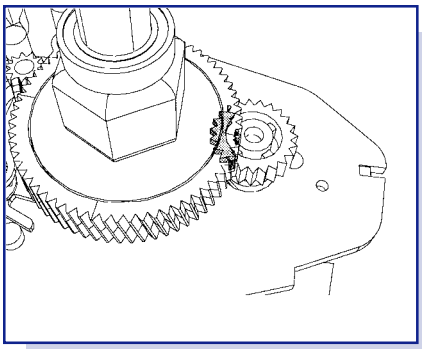
•Complete electronic mock-up: The assembly model includes all parts in the assembly so that you work with an electronic mock-up of the entire product. Instancing techniques allow you to have direct access to the entire assembly while maintaining good performance characteristics.

•Assembly constraints are a continuing extension of the VGX™ functionality within I-DEAS. The assembly constraint mechanism works as the user would expect, making assembly modeling even easier to use. The same constraint icon panel used for wireframe construction is used to constrain parts within an assembly. The same constraint types and flexibility in dimensioning are available.

•Constraints available include:
  •parallel
  •perpendicular
  •coincident and colinear
  •tangent
  •lock
•Constraints displayed directly on the model for easy modification, deletion, information listing, and status checking through the symbol's color coding.
•Show Free gives an intuitive display of constraint status.
•Easily create exploded configurations.
•Animation of dimension value changes.
•"Drag" dimension value for real-time motion studies.
•Assembly relationships: General assembly equations can be written to include engineering parameters, part dimensions, and orientation dimensions. Equations are solved variationally to give you flexibility in working with the assembly.
•Physically distributed/logically integrated: You can create and manage an assembly hierarchy of parts or subassemblies designed by different teams in different locations.
•Multi-user check-out/reference access modes: Multiple users can access designs at the same time. "Check-out" access privileges are provided to those who are authorized to change the design. They can also request to have updates as the design is modified. You can also reference the latest version of a design, with continuous updating or a specific version with the option for future updates.
•Compare different versions of an assembly, before or after updating, to determine changes to hierarchy, constraints, or part geometry.
•Phantom assemblies: Create assemblies tagged as a revision or iteration. This helps you keep multiple iterations of the same part or assembly.
•Bill of Materials: Write out an indented BOM file at any time with control over hierarchy levels and suppress BOM excluded parts and assemblies.
•"Where used": Determine what assemblies use a particular part. When parts are changed, assemblies that use those parts are notified of the change.
•I-DEAS Team Data Manager™ module:
  •Project configuration capabilities.
  •Active notification of design changes.
  •Define and query design states of assembly or part.
  •Assign people to work on a part or subassembly or identify which member of the design team is working on which parts or subassemblies.
•Associative drawings: When the assembly or the parts within it change, associative drawings created using I-DEAS Master Drafting™ software are automatically updated.

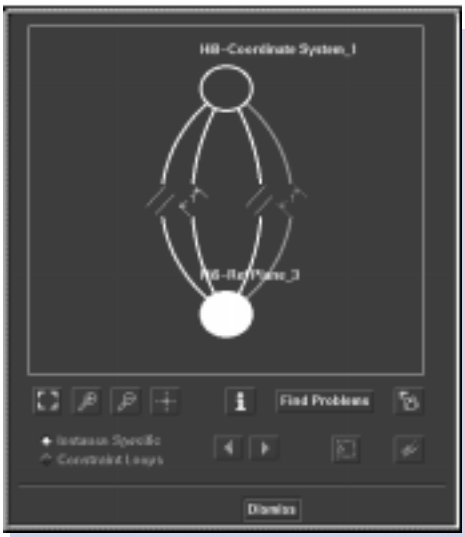
Capture Product Design Intent

The Associative Copy functionality enables you to capture and control the design intent between part instances in an assembly. You manage design intent by copying one or more surfaces and/or reference geometry from one part instance (the source instance) to another (the target instance) within a context assembly.



I-DEAS Master Assembly software is solids-based, so you can resolve packaging problems early in the design process.

Each associative copy relation (ACR) exists within a context assembly. If a member of your design team later modifies the geometry or orientations, I-DEAS software enables you to update the target, which automatically incorporates all the changes to its associatively copied geometry. Designers can specify a point in the part's construction history to use for creating the copy. They can also make the copy independent of orientation, based only on the actual geometry of the source instance. The target instance can then be constrained as desired.



The browser shows constraints and color-coded status.

Experiment with Design Intent

First build associative copy relationships within a "working" assembly. Then make a production assembly of the context. Reuse product designs by copying assemblies and preserving the associative copy relationships.

A graphical browser is available for viewing parts, assembly relations, and constraints. This browser lets you easily view constraints and associative copy relations associated with a selected part instance. The browser also shows important library status information. You can navigate through the entire relations network by interacting with the graphic representation of the dependencies.

Design Evaluation

Once your assembly is designed, you have a full set of tools for evaluating the design to identify design problems before production. Because you are designing in solids, you can easily check interferences and clearances between parts and subassemblies. I-DEAS will display interference volumes and provide a log of parts which interfere with one another. You can animate the motion of kinematic assemblies to evaluate how mechanisms work. Because I-DEAS is a variational system, you can easily vary the lengths of members in the mechanism to study the impact of design changes, and you can articulate the mechanism in real time. You can calculate assembly-level mass and inertial properties.

Concurrent engineering reviews of your products' designs are significantly more effective because I-DEAS provides advanced shaded image capabilities which allow you to explain your design to management, marketing, manufacturing, and purchasing. Once reviewers from these downstream organizations can truly visualize overall appearance and how parts fit together, useful feedback can be provided which helps avoid costly design changes at the end of the cycle.

The following design evaluation features are available with I-DEAS Master Assembly:

- Interference checking: Comprehensive automatic volume interference and clearance checking.
  - Easily specify which parts or assemblies will participate in an interference check.
  - Display and create the geometry that represents the interface volume or minimum clearance distance.
  - Proximity measurements to determine closest distance between parts.
  - List and sort the results of the interference checks by either the instance sets' name or results.
  - Calculate and sort results for either the interference, clearance, or both between two sets of selected instances.
  - Calculate interferences for multiple orientations.
  - Format and save the results of the check through the Report Writer.
- Properties: Part and assembly level properties calculation with different densities allowed for each part. Properties information can be manipulated with the I-DEAS Report Writer and can be written to a file. Property calculations include surface area, volume, mass, moment of inertia, center of gravity, principal axes, and principal moments of inertia. Material properties are directly available from the I-DEAS material database.
- Visualization: Exploded, section, perspective, hidden line, and advanced shaded image views. User-defined orientations for assembly geometry are storable for recall, animation, and drawings. A single drawing can contain multiple assembly configurations.

I-DEAS Tolerance Analysis™

I-DEAS Tolerance Analysis software provides users with the capability to evaluate the tolerance specifications of their design to get engineering performance at the lowest possible manufacturing cost. It uses variational geometry techniques to determine worst case and statistical tolerance stack-up between mating parts in a complex assembly. In addition, you can measure the sensitivity of a critical dimension in an assembly to changes in individual constraints. This enables you to reduce manufacturing cost by only tightening the tolerances which contribute most to the overall variation of a critical dimension and loosening tolerances that have little impact.

Tolerance Modeling

Tolerance models are created by relating fully constrained 2D variational sections or wireframes. The sections can be quickly extracted from the I-DEAS Master Assembly models, eliminating the need to recreate geometry. Geometric, dimensional, and tolerance constraints can be added to the tolerance model at any time. The tolerance model can be automatically checked for constraint and datum validity. Once all of the sections have been fully constrained, the reference dimension to be analyzed is specified. Using this dimension as the focus for the analysis, the software calculates the probability of holding this tolerance while varying the tolerances of all other constraints. I-DEAS Tolerance Analysis modeling capabilities include:

- Building tolerance models using 2D sections or wireframe created with the powerful geometry-creation capabilities of I-DEAS Master Modeler™ software.
- The Dynamic Navigator™ user interface guides geometry and constraint creation to accelerate the model creation process.
- Extract 2D sections from solid assemblies in I-DEAS Master Assembly software to eliminate the need for recreating geometry.
- Constraint creation implicitly defines datums allowing you to create the tolerance model to capture specific manufacturing intent.
- The ability to set default tolerances lets you quickly place tolerances on different types of dimensions or constraints.
- Equational relationships let you incorporate interpart relationships into the tolerance model.

Analysis Results

The tolerance analysis is performed using a completely 2D variational method. I-DEAS Tolerance Analysis software offers a range of analysis types which vary in depth and complexity. A sensitivity analysis feature guides you through a tolerance analysis by informing you of the relationships between the constraints and the reference dimension.

By paying close attention to the sensitivity analysis, you can evaluate and focus on only those constraints that are large contributors to the reference dimension. A comprehensive analysis, which includes linear and nonlinear solutions, calculates statistical and worst case stack-up, sensitivity, percent contribution of each constraint to the reference dimension, and rate of acceptance for the tolerance model. Using the sensitivity and percent contribution results as guidance, you can loosen tolerances on low contributors, and tighten tolerances on only the high contributors, which in turn will improve the quality of the design while reducing manufacturing costs. The analysis results are calculated in seconds which allows you to perform design iterations quickly.

The type of results available:

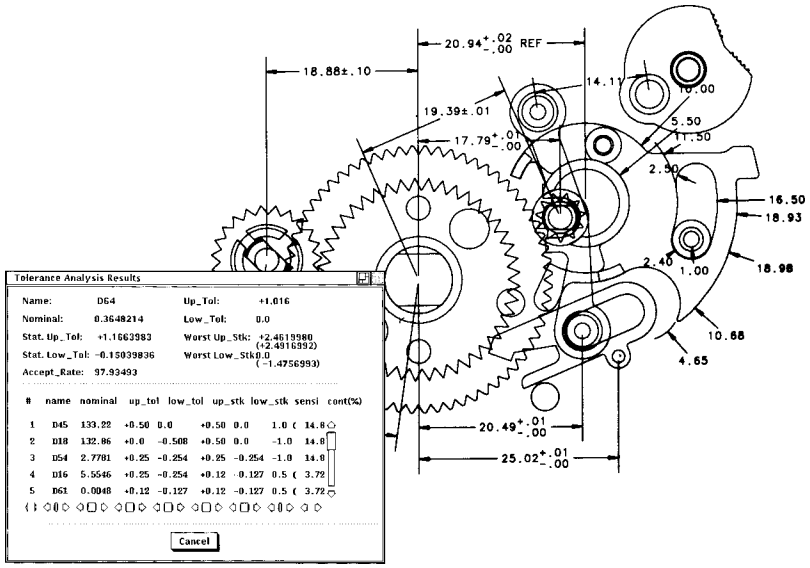
- Validity checking evaluates the integrity of the tolerance model to help guide you to creating models with properly defined datums and constraints.
- A sensitivity analysis allows you to understand the geometric relationships between the constraints of the tolerance model.
- The percent contribution feature shows you which dimensions and constraints have a higher impact on the analyzed dimension.
- A standard analysis performs a linear calculation to rapidly provide tolerance analysis results.
- A comprehensive analysis performs a nonlinear calculation to provide significantly more accurate tolerance analysis results.
- The statistical stack-up results show you the statistical upper and lower tolerances of the reference dimension.
- The worst case stack-up results show you the worst case combination of the maximum/minimum dimensions in the tolerance model.
- The acceptance rate feature shows you the rate at which you can expect to reliably manufacture the model within the specified tolerances.

Prerequisite

Core Master Modeler

For More Information

For more information, contact your local SDRC representative or call 1-800-848-7372.



Stack-up and sensitivity analysis results provide design guidance for identifying tolerances that have the greatest impact on assembly variations.