Surfacing Set

advanced surface modeling capabilities and standard geometry interfaces

I-DEAS® Master Surfacing™

I-DEAS Master Surfacing software is the advanced surface modeling complement to the I-DEAS Master Modeler™. It helps you quickly and easily design and iteratively modify complex sculptured surface parts. I-DEAS Master Surfacing provides a rich set of curve and surface creation tools for lofting, sweeping, and blending surfaces, giving you excellent local and overall control of surface shape. Not only can you create your shape, but you can also easily make design changes because relationships between geometry entities such as surface tangencies are maintained throughout the design effort. Advanced fairing operations help you remove bulges and achieve excellent local shape control of free-form surfaces. As a result, changes can be rapidly examined without the need to regenerate each individual surface. The result is a smooth, attractive, highly engineered, and manufacturable surface that enhances the design of your product.

Modeling Foundation

I-DEAS software is NURBS (Non-Uniform Rational B-Splines) based. NURBS geometry allows you to accurately model analytical, highly sculptured surfaces without approximation, using a single basic set of commands. The result is a set of surfaces or a topologically complete trimmed surface solid model. The model can participate in all geometric modeling operations, interference checks, mass properties calculations, hidden line removal, and shaded image creation. Major features include:

•Fully integrated surface and solid modeling.
•Double precision NURBS modeling represents arcs, conics, and high-degree Bezier curves without approximation.
•Unlimited control points per entity.
•Completely integrated unified wireframe, surfaces, trimmed surfaces, and solid data structure.

Modeling Complex Surfaces

Once you master a small set of curve and surface modeling commands, the power of an advanced surface modeler is available to you. I-DEAS includes a full set of construction tools for creating and manipulating curves and surfaces. These tools provide exceptional local and overall control of curves and surfaces.

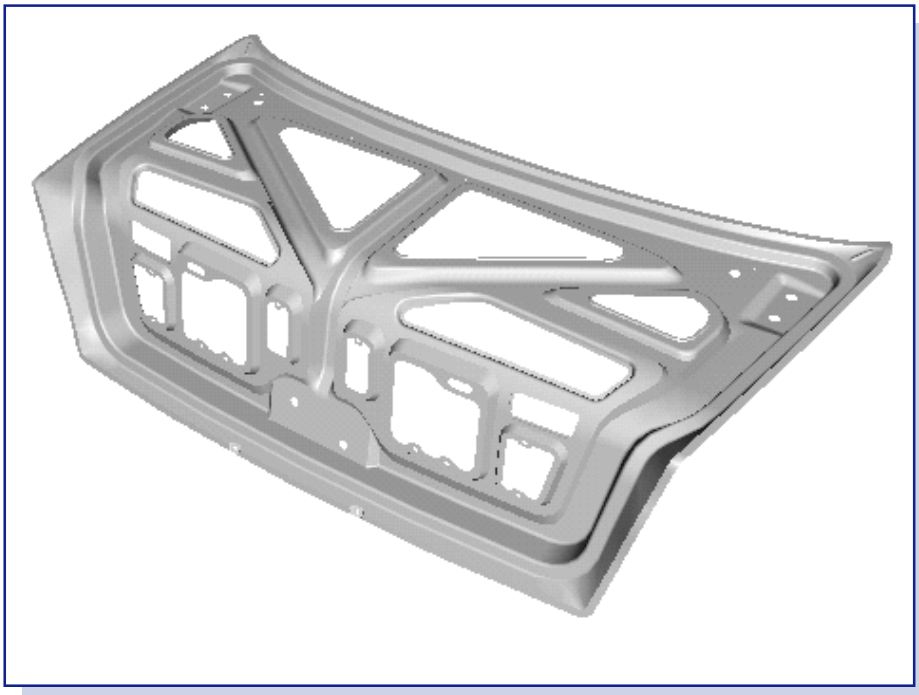
The following are some key capabilities:

Curve Operations

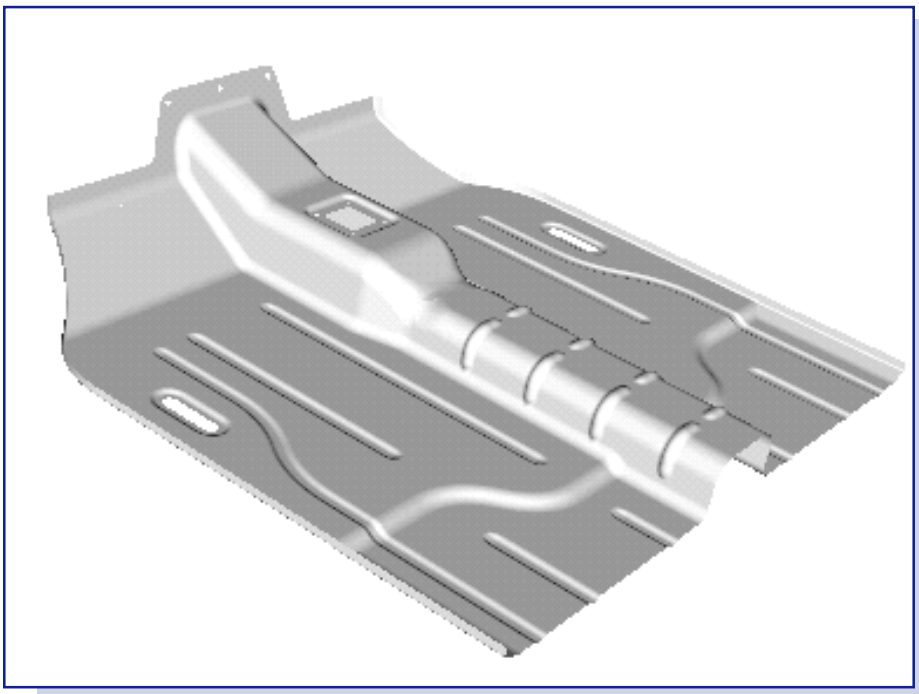
•Accurate fitting of unevenly spaced points.
•Conic curves.
•Tangency, curvature, and inflection control.
•Extract curves from surface intersections and edges of parts.
•Extract curves from surface ISO parametric lines.
•Project onto a surface.
•Curves created through a series of surface points.
•Offset curves, associative.
•Stretch, join, or match curves.

Surface Operations-Creation and Modification

•Planar and ruled surfaces.
•Surfaces of revolution.
•Lofting:
  •Use a minimum of one cross section and two rails, or two rails to define the surface.
  •Use just cross sections or cross sections and rails to control surface shape in two directions.
  •Control surface tangency at each defining section.
  •Optional control of mapping between cross sections with differing numbers of curves.



I-DEAS Master Surfacing provides lofting, sweeping, and blending capabilities which allow associative feature-based definition of extremely complex geometry. Color contour displays help you clearly interpret surface curvature.



The I-DEAS Master Surfacing toolset enables designers to streamline the design of stamped sheet metal components by creating an associative feature-based surface model, and then simply specifying a thinckness to create the solid model using the shell feature. The variational surface feature enables designers to quickly create common stamped features like beads and dimples.

- Sweeping:
  - Path controls the shape of the surface in one direction.
  - Minimum of one path curve and one cross section needed to model surface.
  - Surface is automatically interpolated between shapes of cross sections.
  - Cross section curves for sweeping and lofting may be open and non-planar.
  - Various methods for controlling orientation of cross sections.
- Mesh of curves:
  - Create sections in two directions.
  - Single surface is created.
- Points: Highly sculptured surfaces can be created from point data imported from 3D digitization, or from special purpose analysis/design tools.
  - Ordered mesh of points.
  - Random cloud of points.
- Use existing surfaces and solid edges as defining curves when creating surfaces. New surfaces are automatically stitched and associative to these edges.
- Automatic mid-surface generation: A generalized approach, independent of feature creation, extracts mid-surface geometry for use in shell meshing of molded and cast parts.
  - Fully automatic mid-surface generation for most parts, plus additional interactive tools.
  - Automatic surface extension and trimming and in-surface feature suppression are available.
  - Shell element thickness is automatically derived from solid part geometry using an icon.
- Tangency control:
  - Control tangency at surface boundaries either by using an existing edge or surface, or by defining tangent vectors at surface end boundaries.
  - Tangency weighting.
- Trim, extend, merge, and stitch/unstitch surfaces.
- Surfaces imported from other CAD systems can be sewn-up into solids and used to trim other surfaces or solids.
- Split and merge surface edges.
- Non-manifold geometry abstraction tools for such operations as creating internal partitions within the part model.
- Dynamic curve and surface manipulation:
  - Modify surfaces by dragging points in 3D space.
  - Position modification effects within a zone.
  - Apply magnets and other tools to control shape.

Variational Sweep

Variational Sweep takes the “sketch-in-place” concept introduced in a previous version of I-DEAS software for planar geometry, and extends it to complex free-form geometry.

Variational Sweep lets you sketch a variational section “in place” that will follow multiple rails (curves or surface edges), positionally and with surface edge tangency. The implementation allows you to create, with a few familiar commands, surfaces that in other systems take an order of magnitude more difficult user interactions to develop.

I-DEAS Master Surfacing allows you to directly incorporate styled surfaces from Imageware™ Surfacer® or other styling packages, and use them to associatively drive the freature-based design of complex components and assemblies.

Sample situations that can be addressed with Variational Sweep are:
•multi-rail sweep.
•variable radius blends with sliding/ tangent edges.
•true dimension-driven free-form surfaces.
•modeling of draft on free-form surfaces.

Ease of Design Change and Shape Control

I-DEAS software uses a variational constraint-based approach to surface and solid modeling. This technology lets you easily capture design intent, thereby allowing design changes to be made rapidly with unparalleled associativity.

Surfaces are associated to underlying curves and part edges. When a part design changes, surfaces associated to the part change with it automatically. The variational capabilities of I-DEAS also allow you to create equational relationships between surface control variables to control surface shape.

In addition, for free-form surfaces that are not easily defined by dimensions and equations, I-DEAS provides industry-unique variational shaping tools which allow you to achieve your desired surface shape. These methods use energy-minimization techniques to shape underlying surface curves using advanced high-level operations such as pushing, twisting, repelling, and attracting to intuitively shape geometry. You can achieve fairness of the resulting shape by interacting directly with the real geometry - not with control points, weights, and knots as in traditional surface modeling systems. The following important capabilities enhance your ability to control and reshape surfaces to achieve difficult styling or engineering objectives:
•Surfaces are associative to defining curve/part edges and update with changes to the parent solid.
•Variational shape control via modification of dimensional or geometric constraints.
•Tangency associativity: Surfaces constrained to be tangent remain so after design changes.
•Surfaces can be controlled by equations.
•Advanced energy-based curve smoothing and shaping tools act directly on real geometry instead of intermediate control points.
  •Achieve slowly varying curvature properties and eliminate undesirable local bulges (fairness) which can detract from the aesthetic, machining, or aerodynamic properties of your surface.
  •High-order end/edge control including exact fixed boundary conditions.
  •High-order exact tangency and curvature, continuity control at curve/surface junctures.
  •Intentionally introduce local bulges or inflections on curves while maintaining global smoothness.
  •Shape curves locally to fit specific point geometry or to follow the shape of existing geometry.
  •Rigidity control allows the shaping of a portion of the geometry while keeping the remainder fixed.
  •Indirect shaping tools allow most of the geometry to achieve flatness or cylindricity while also maintaining given end conditions.

•Continuous intensity controls to define relative strength with which geometry resists such operations as flattening or stretching.
•Direct real-time user interaction which drives the shaping process and provides direct visual feedback.
•Connector constraints join curves into curve networks. Moving a connector moves all attached curves.

Component Modeler Link

I-DEAS software supports the use of an external geometry application to create and modify orphan leaf features. This capability utilizes the Open I-DEAS functions to provide the communication between the applications. This advanced functionality is intended to provide for the associative integration of special purpose geometry applications. External applications currently leveraging this capability include ICEM Surf, Alias AutoStudio, and Imageware Surfacer.

Visualization and Analysis

With surfaces and solids created in I-DEAS Master Surfacing software, you can use all I-DEAS visualization tools including shaded images, hidden line processing, perspective views, and evaluated surface displays. In addition, to help you evaluate curves and surfaces, specific display capabilities and evaluation tools are available including:
• Curvature analysis via color contour display or Isolines of Gaussian, mean, or principal curvature.
• Surface normal/tangency display vector normal to or tangent to surface or curve.
• List curvature and normal values of surface at a point.
• Check surface/surface boundaries.

Prerequisite

Core Master Modeler
-or-
I-DEAS Product Design Package
-or-
I-DEAS Artisan™ Package

For More Information

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