



What's New in  
Geomagic Studio 10

---

*December 17, 2007*

*Document Version C*

the magic of making it simple™

### About Geomagic

---

Geomagic ([www.geomagic.com](http://www.geomagic.com)) simplifies digital shape sampling and processing (DSSP) for more than 5,000 professionals in industries such as automotive, aerospace, medical devices, and consumer products. The company's products and services are used to enable mass customization with the same efficiency and cost as mass production, improve dental care with individually designed devices, speed time to market for consumer products, automate inspection for better quality in dramatically less time, increase safety for NASA shuttle missions, and optimize design for everything from racing cars to blimps. Geomagic has headquarters in Research Triangle Park, N.C., subsidiaries in Europe and Asia, and distributors worldwide.

### Copyright

---

© 2008, Geomagic, Inc. All rights reserved.

Information in this document is subject to change without notice. No part of this document may be reproduced in any form or by any means including photocopying, recording, or microfilming or by any information storage and retrieval system including a web site, without the written permission of Geomagic, Inc. No liability is assumed by Geomagic, Inc. with respect to the use of the information contain herein. While every precaution has been taken in the preparation of this documentation, Geomagic, Inc. assumes no responsibility for errors or omissions. References in this document do not constitute an endorsement of any products or services.

Geomagic, the Geomagic logo, Geomagic Studio, Geomagic Qualify, Geomagic Review, Geomagic Blade and "the magic of making it Simple" are either trademarks or registered trademarks of Geomagic, Inc. Other trademarks, trade names, or product names mentioned are the property of their respective owners.

Geomagic, Inc., PO Box 12219, Research Triangle Park, NC 27709 USA [www.geomagic.com](http://www.geomagic.com)



## Table of Contents

---

OVERVIEW .....	4
FASHION PHASE – NEW .....	5
Fashion Phase Workflows.....	6
Workflow 1: Extracting Untrimmed Surfaces .....	6
Workflow 2: Creating Trimmed Surface Models .....	7
Contours > Extend > Adaptive – NEW .....	9
Contours > Edit Extensions – NEW .....	10
Creating Surfaces – NEW .....	11
Classify Operation .....	11
Filter Operation.....	12
Fit Primaries Operation.....	12
Fit Connections Operation .....	16
Analyze Operation .....	16
Trim and Stitch Operation .....	17
SHAPE PHASE .....	19
Contours > Edit Extensions – NEW .....	19
STREAMLINED FEATURE FRAMEWORK - NEW .....	20
Tools > Features > Create Features - EXPANDED .....	20
Tools > Features > Edit Features – EXPANDED.....	22
Right-Mouse Menu of a Feature includes Properties – NEW .....	23
Tools > Features > Modify Feature Display – NEW .....	23
Tools > Alignment commands – MODIFIED .....	23
INTEGRATED HARD PROBING .....	24
Tools > Alignment > 3-2-1 Alignment with Hard Probe - NEW .....	24
Tools > Features > Create Hard Probing Features - NEW .....	25
ENHANCED USER INTERFACE .....	26

### OVERVIEW


---

Geomagic Studio 10 offers new tools and capabilities to accurately create a model of an as-built part or to capture the *design intent* of a part. Geomagic Studio 10 includes the following:

- New Geomagic Fashion module for creating optimized, CAD-ready surfaces from digitized objects including
  - automatic detection of distinct regions and classification of regions by type. Types include planes, cylinders, cones, spheres, swept (extruded, drafted extruded, rotational), and free-form surfaces,
  - automatic fitting of surfaces in classified regions,
  - automatic extraction and optional editing of profile curves for extruded, drafted, and rotational surfaces,
  - automatic creation of smooth transition surfaces and complex corner patches,
  - extraction of untrimmed surfaces from bounded regions,
  - creation of fully stitched surface models containing trimmed faces,
  - a variety of graphical and statistical tools to evaluate and enhance surface quality,
  - exporting reconstructed surface information into leading CAD systems.
- New editing tools for creating, modifying, and relaxing extended contour networks in the Shape and Fashion Phases
- Streamlined Feature framework
- Multi-sensor metrology support for users who wish to complement 3D scanning with hard probing
- Enhanced user interface

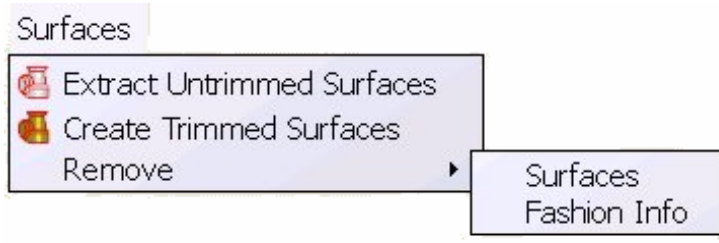
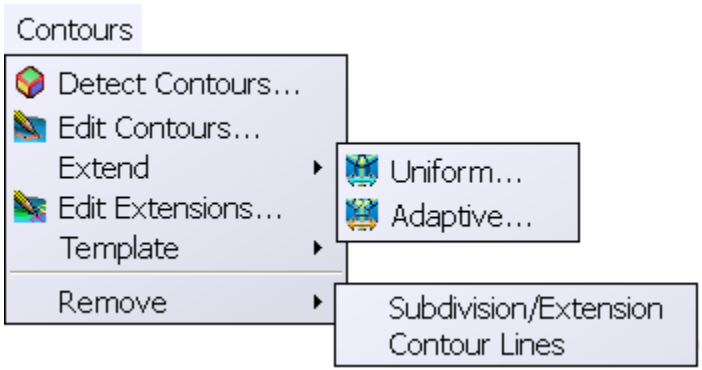
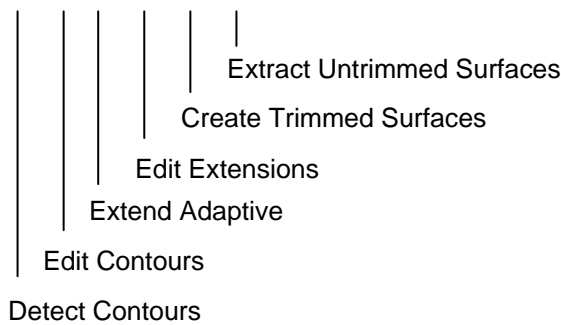
## FASHION PHASE - NEW

The new Fashion Phase (an alternative to Shape Phase) allows the creation of CAD-ready surfaces that represent the *design intent*. For example, plane-like surfaces are optimized to perfect planes, and cylinder-like surfaces are optimized to perfect cylinders.

The new **Edit > Surface Phase**  command allows the user to choose Fashion Phase or Shape Phase, depending on the type of surfacing that is desired.

**Benefit:** Fashion Phase captures design intent automatically, with high quality surfaces, and with smaller output files.

The Fashion Phase menus and toolbar are available only if the Fashion license is installed.

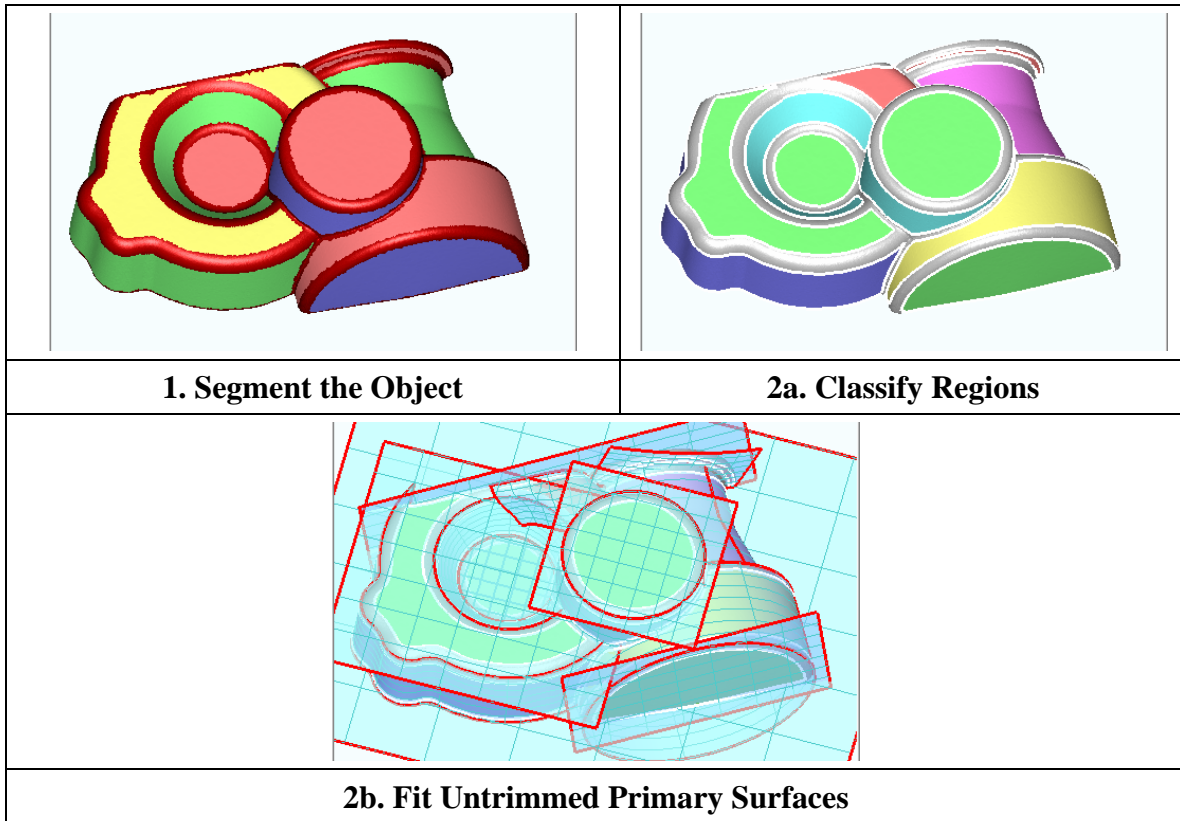


## Fashion Phase Workflows

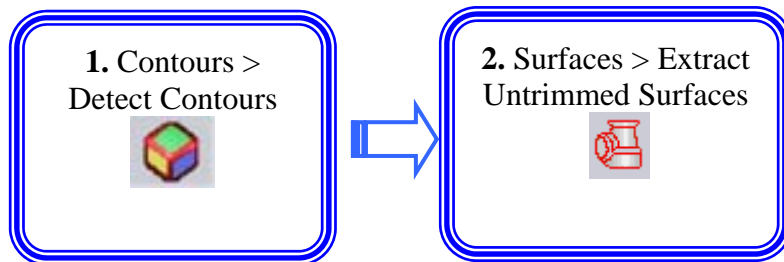
A Geomagic workflow is a sequence of commands that yield a desired outcome. The Fashion Phase offers two main workflows.

### Workflow 1: Extracting Untrimmed Surfaces

**Surfaces > Extract Untrimmed Surfaces.** In this workflow, the user can create a set of untrimmed primary surfaces, and export them to a CAD system to recreate a parametric model.

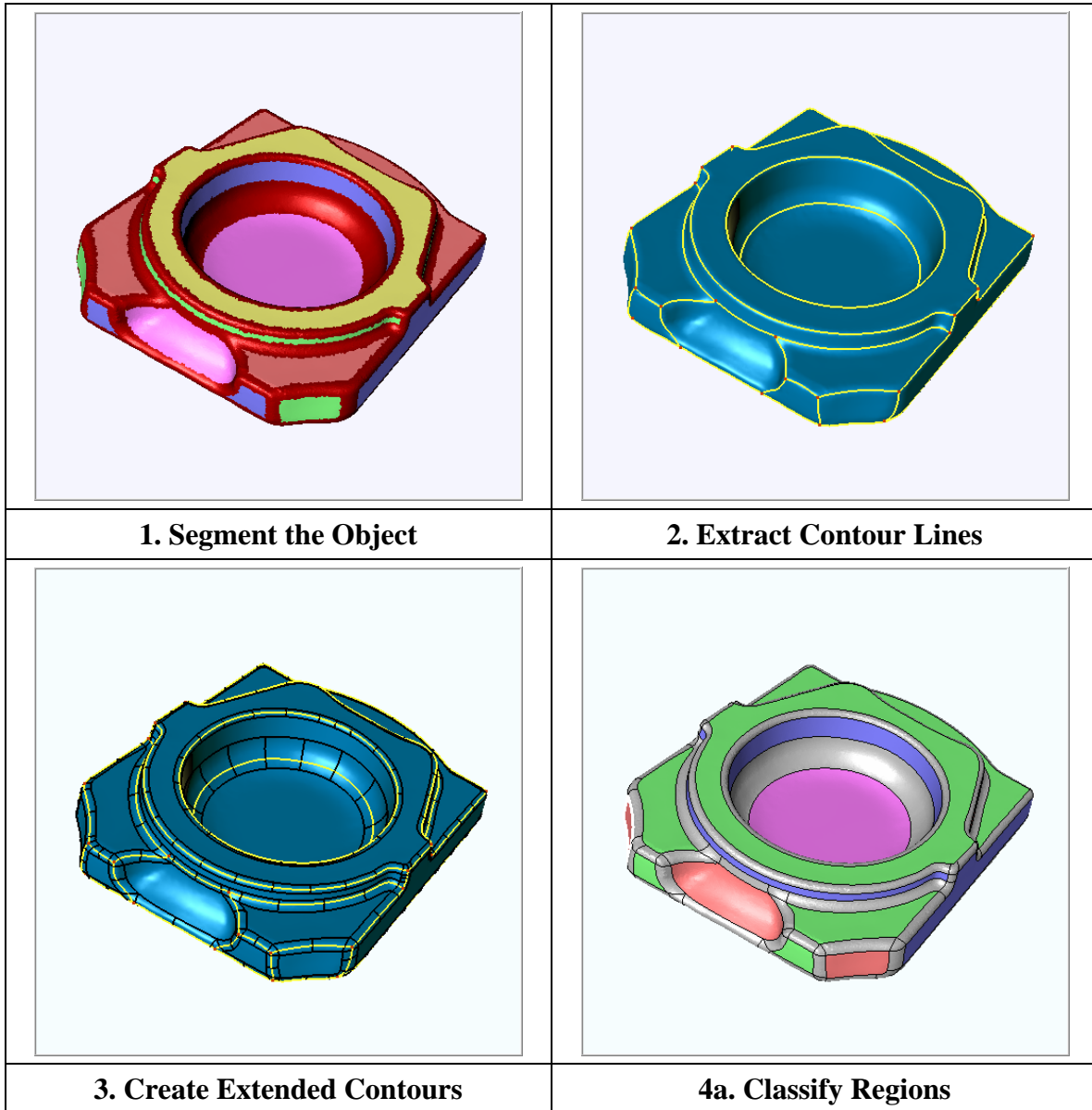


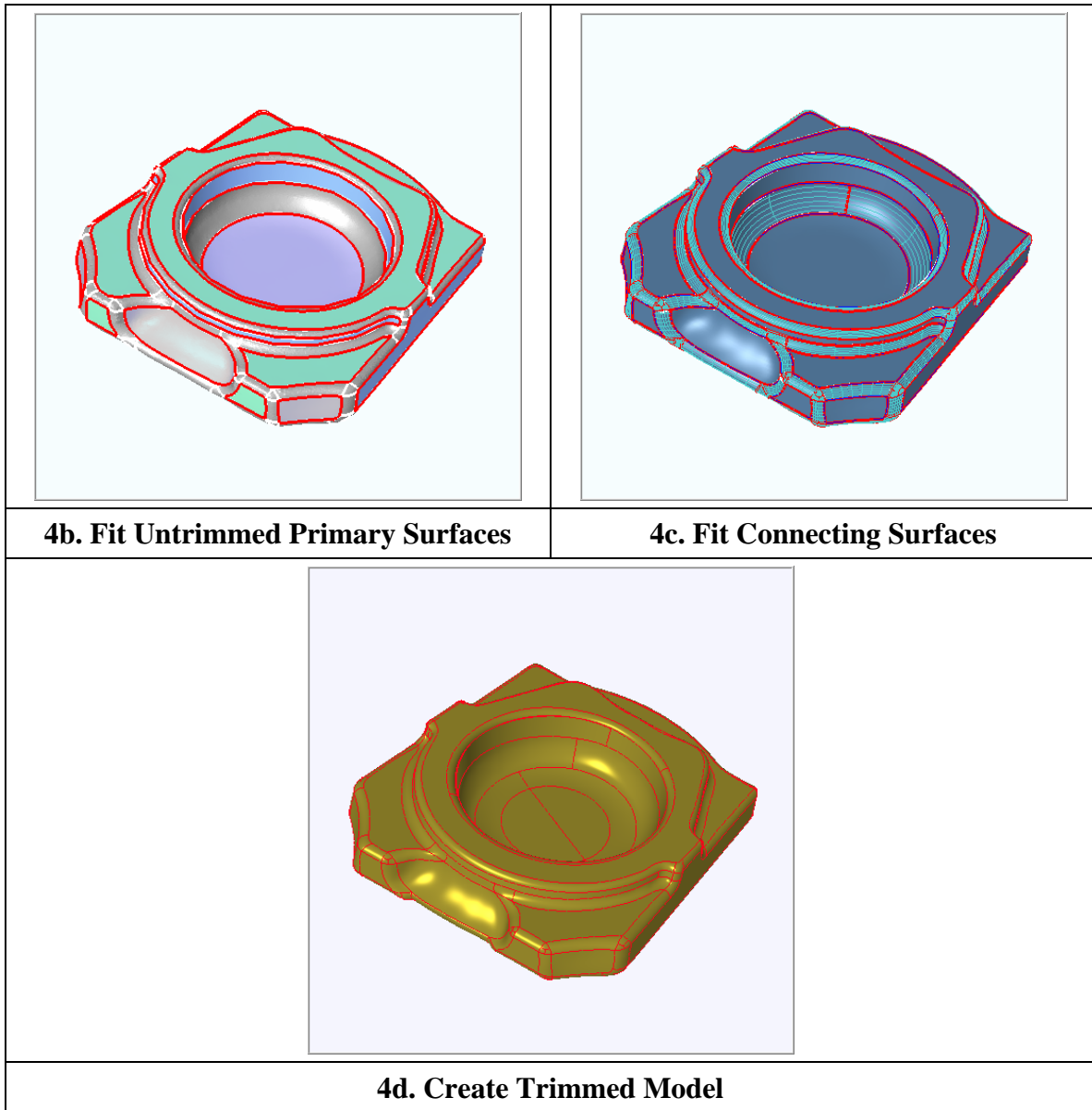
This is accomplished using the following sequence of commands



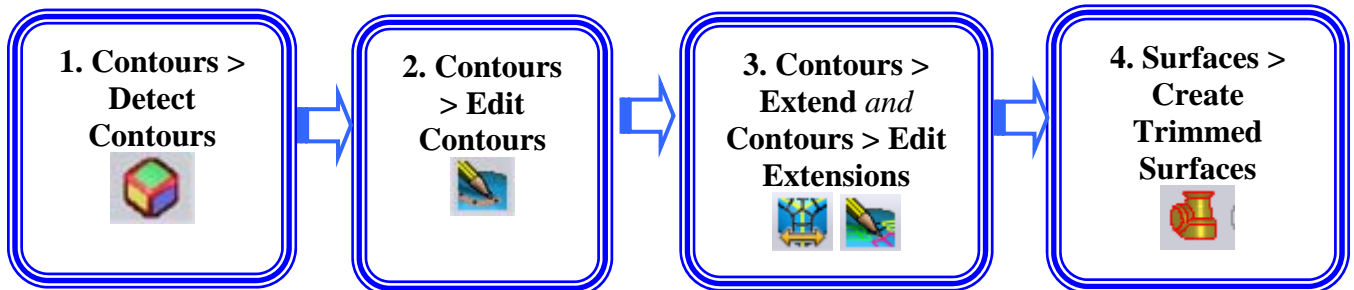
## Workflow 2: Creating Trimmed Surface Models

In this workflow, the user can create a full trimmed model consisting of trimmed primary surfaces and connecting features.



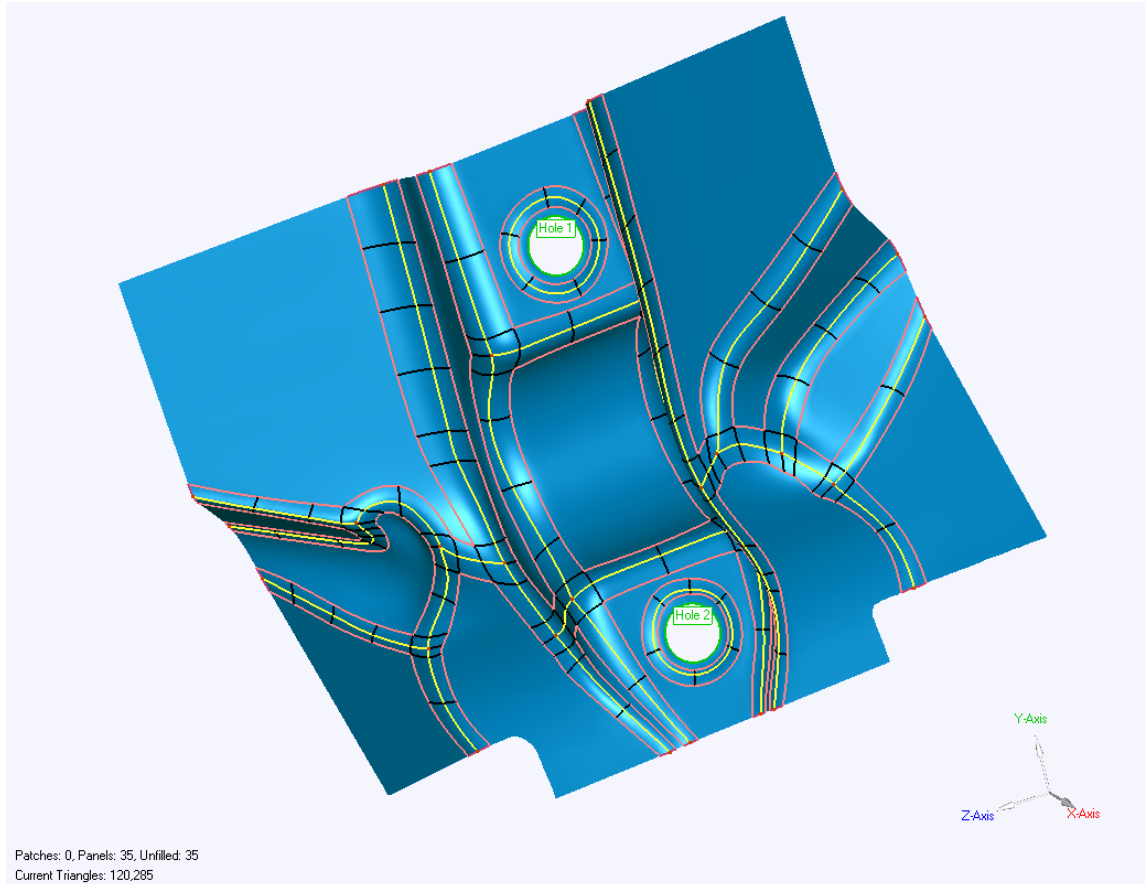


This can be done in Fashion Phase with the following sequence of commands:



### Contours > Extend > Adaptive - **NEW**

In order to create a trimmed model in Fashion, the user must first create an extended contour structure. The extended contour structure needed for CAD-ready surface modeling is different than the one used by Shape, and more naturally reflects a CAD-ready structure.



As in the Shape Phase, contour lines are placed by **Contours > Detect Contours** and modified by **Contours > Edit Contours**. Next, the contour lines are extended to form extension structures by either of two methods:

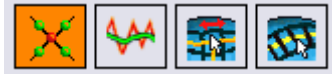
- **Contours > Extend > Adaptive** is a new extension method that creates CAD-ready contour structures. Simply enter **Contours > Extend > Adaptive** with a set of unextended contour lines, and press the **Extend** button.

This method is preferred in the Fashion Phase because it creates an extended contour structure that adapts to the width of the high-curvature regions, even if they are variable-radius, and because it creates adaptive corner patch structures that yield high-quality connecting surfaces.

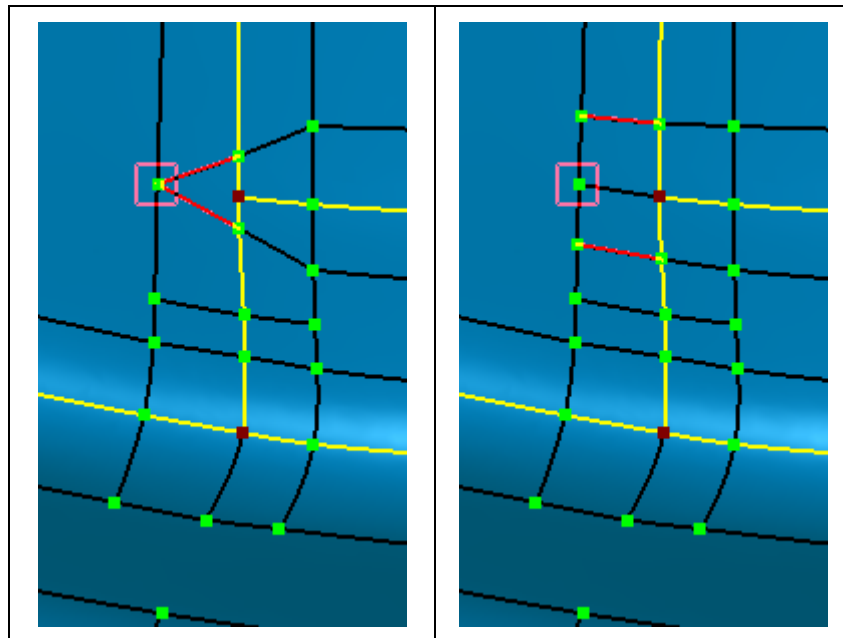
- Use **Contours > Extend > Uniform** to create extensions, and then use the **Create T-nodes** button inside of the **Spring Curve** operation of **Contours > Edit Extensions**. This automatically creates T-nodes where neighboring contours become collinear.

## Contours > Edit Extensions - **NEW**

In the Fashion Phase, **Contours > Edit Extensions** can be used to edit extended contour structures. When editing extended contours, the available operations are:



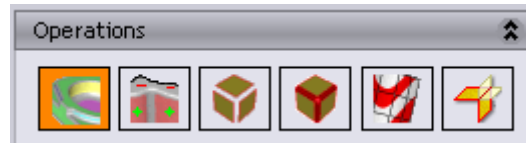
- **Edit** – Perform basic editing of the extended contours. With extended contours, you cannot change the structure, only reposition the edit points. Operations include:
  - moving a point
  - offsetting a contour or an extension contour by selecting the curve, and dragging
- **Relax** – In this mode, select a contour to smooth it.
- **Spring Curve** – With this operation, you can select a three-sided corner patch to expand it to four-sided.
- **Cross Curves** – This operation allows you to add cross-curves in the middle of an extended contour.



Adding a spring curve

## Creating Surfaces - **NEW**

The **Surfaces > Create Trimmed Surfaces** and **Surfaces > Extract Untrimmed Surfaces** commands offer the following *operations*:



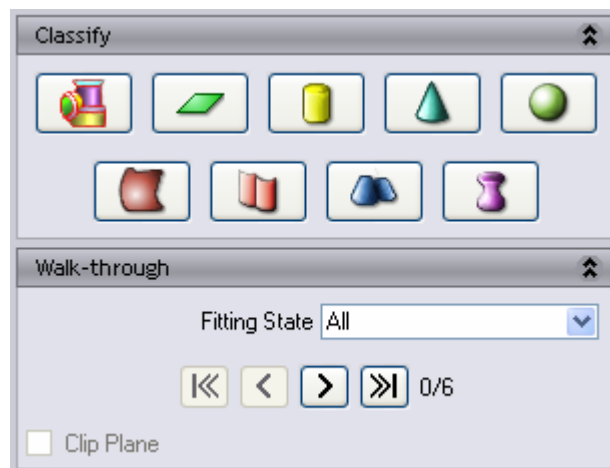
- **Classify**
- **Filter**
- **Fit Primaries** (Primary surfaces are the planes, cylinders, cones, free-forms, and other surfaces that give the object its primary shape)
- **Fit Connections** (only in **Surfaces > Create Trimmed Surfaces**)
- **Analyze**
- **Trim and Stitch**

The user works through the several operations typically from left to right (starting with **Classify** and ending with **Trim and Stitch**). It is possible, however, to step backward to modify parameters and add or subtract surfaces from the set being processed.

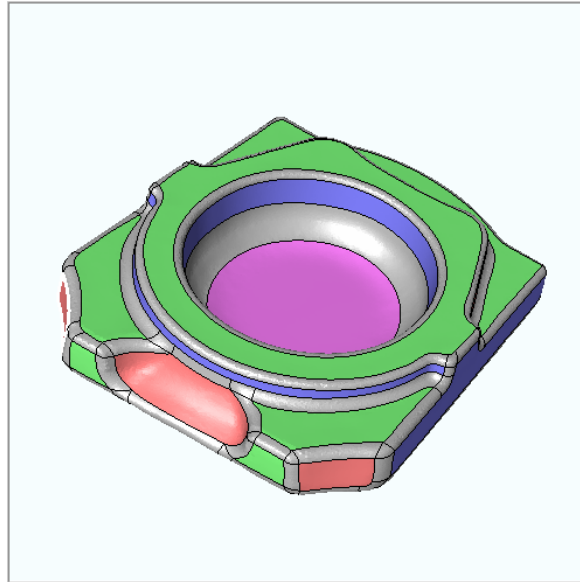
### Classify Operation

The first step is to classify all the regions found by **Contours > Detect Contours** by their basic shapes. Classification can be performed automatically or manually.

- Planar surfaces
- Cylindrical surfaces
- Conical surfaces
- Spherical surfaces
- Free form surfaces
- Extruded surfaces
- Drafted extruded surfces
- Rotational surfaces



Each type of surface is displayed in a different color for easy identification. For example, green indicates planes, and yellow indicates cylinders.



A set of surfaces classified by their basic types.

### Filter Operation

After the initial classification, the user might decide that it is more convenient to work on just a portion of the model. In this case, use the **Filter** operation to limit the set of surfaces, based on their surface types, on which the remaining operations will have effect.



Filtering the set of surfaces. Here, all surfaces are "turned on" and therefore included in future operations.

### Fit Primaries Operation

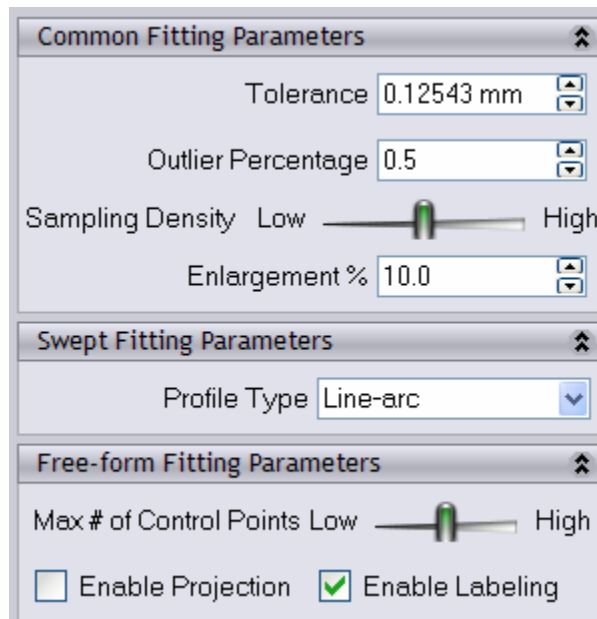
In this operation, all selected primary surfaces are forced to assume the shapes by which they are classified. For example, surfaces classified as planes become perfect planes, and surfaces classified as cylinders become perfect cylinders.

The set of surfaces that are selected for this fitting can be limited even further than the set that passed the Filter operation. With a mouse click, the set can be limited to a few or even just one surface.

## What's New in Geomagic Studio 10



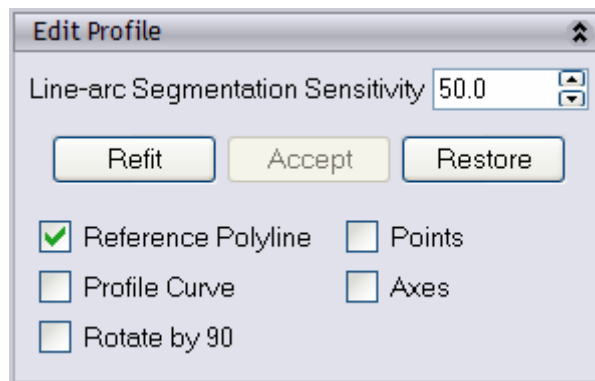
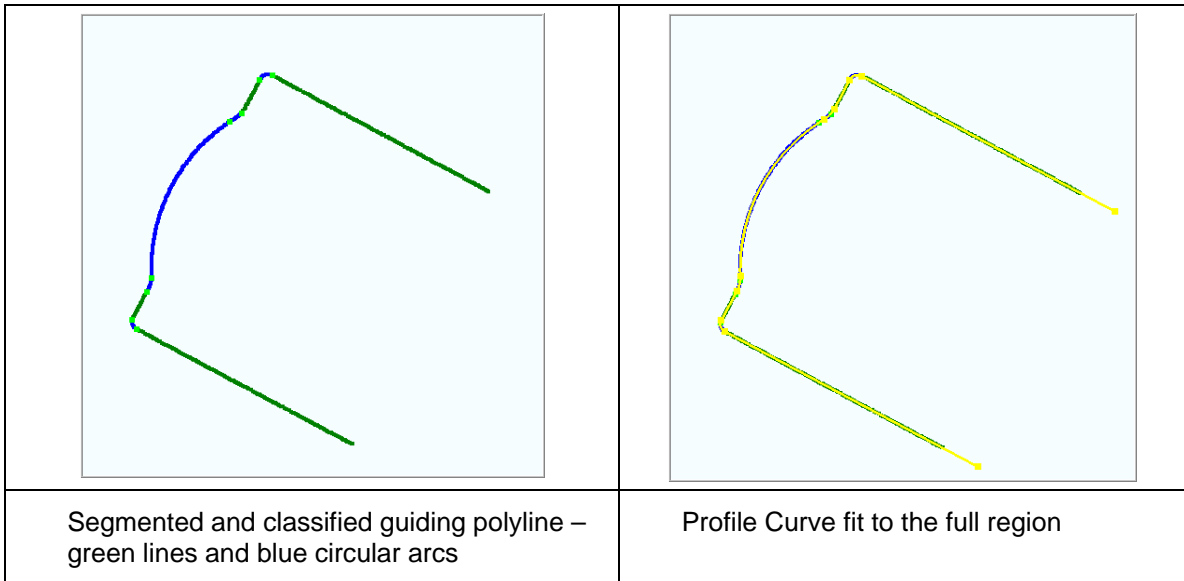
When fitting the primary surfaces, the user can control fitting parameters such as fitting tolerance and outlier percentage. The size of the primary surface can also be extended by a percentage, in preparation for manual trimming outside of Studio 10 (such as in an external CAD application).



Depending on the types of surfaces to be fitted, additional parameters are available..

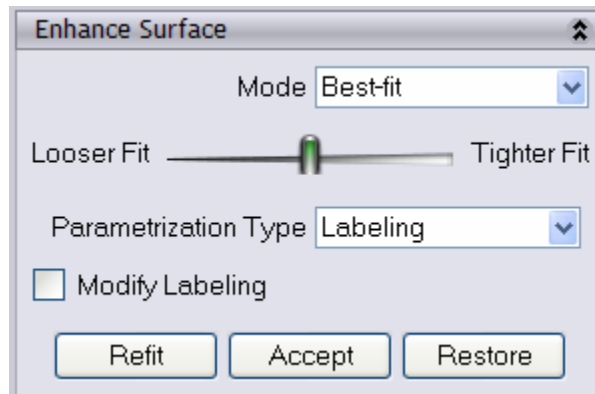
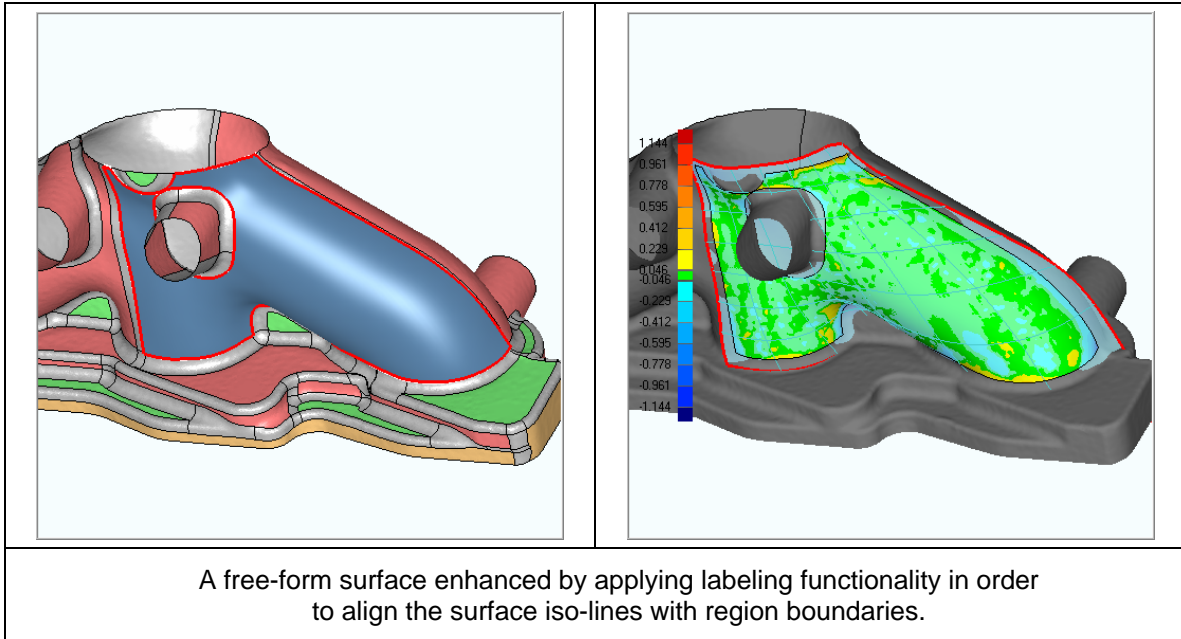
## *Edit Profiles function (of the Fit Primaries Operation)*

Simple *swept* surfaces (extrusions, drafted extrusions, and rotational surfaces) are defined by means of 2D profiles. There are two types of profiles: free-form and line-arc; the latter is represented by a sequence of connected straight line and circular arc segments. The Edit Profiles function allows the user to modify the 2D profile of a swept surface by adjusting a sensitivity value or by inserting/deleting endpoints to create a new structure of curve segments.



## *Enhance Free-Form Surfaces function (of the Fit Primaries Operation)*

Fitting free-form primary surfaces to geometrically complex regions is a difficult task. Fitting is controlled by a tolerance value and an outlier percentage. The system optimizes the number of control points and the smoothness of the fitted surface. If the accuracy is not sufficient or the surface quality needs to be improved, the user can apply special parameterization techniques and manually overwrite the fitting parameters.



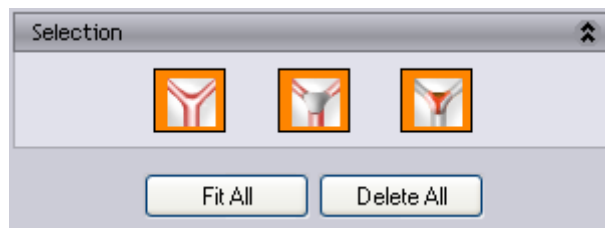
### Fit Connections Operation

Connections are the surfaces that connect two or more primaries. These are known in CAD systems as fillets or blends.

After the fitting of the primary surfaces, the user may fit connecting surfaces between the created primaries. This step is not strictly necessary because it can also be performed later by the external CAD system.

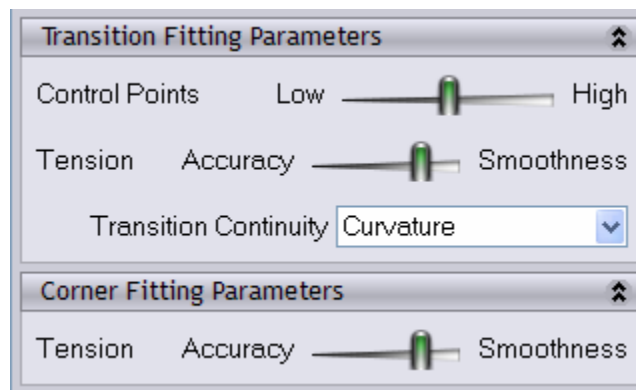
There are two types of connecting surfaces:

- transitions (connecting two primary surfaces)
- corners (connecting three or more transition or primary surfaces)



Connecting surfaces can be fitted all at once, filtered and fitted as group, or individually fitted.

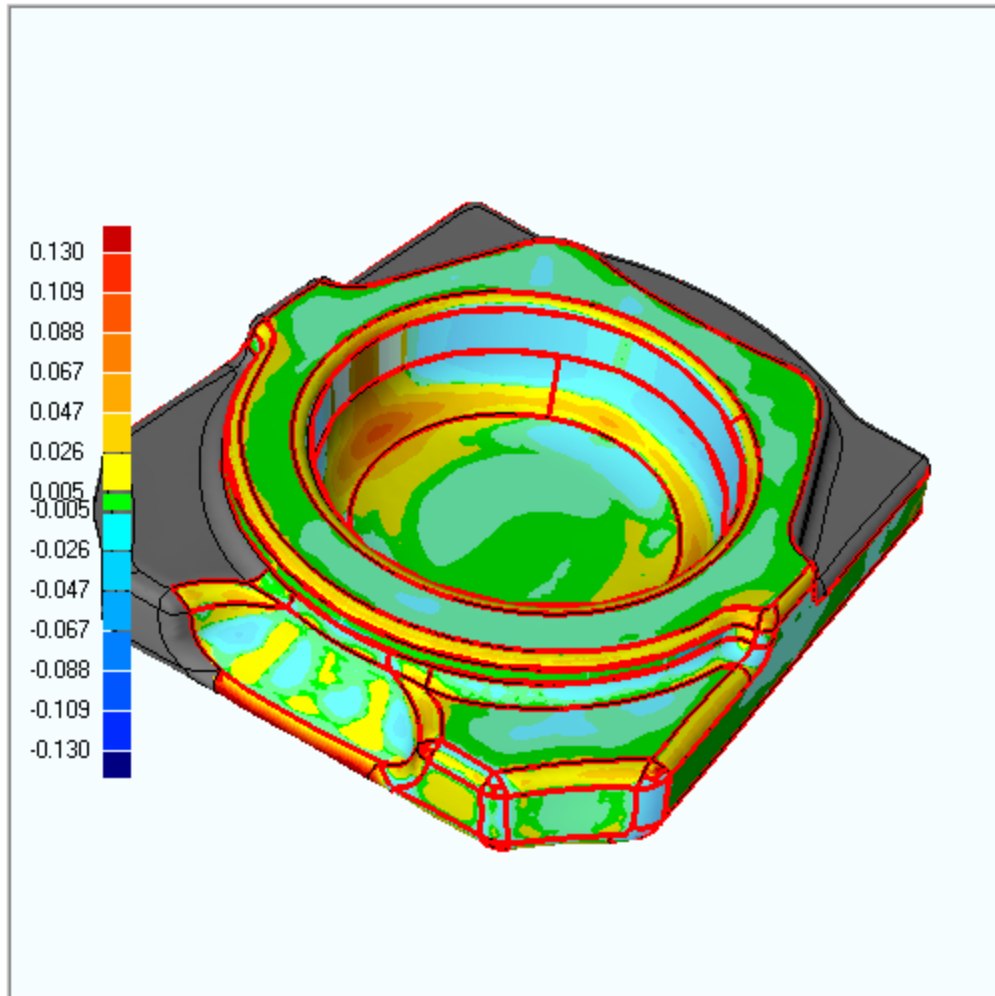
Parameters for the fitting can also be specified and applied for the entire group or for the individual surface.



### Analyze Operation

This operation allows the user to review the fitting process. Various display options are available to inspect the surface quality, to render the surfaces in as trimmed or untrimmed, and to render iso-lines and/or control points. In addition, the Analyze Operation can limit the inspection to only those surfaces that experienced excess movement when they were fitted.

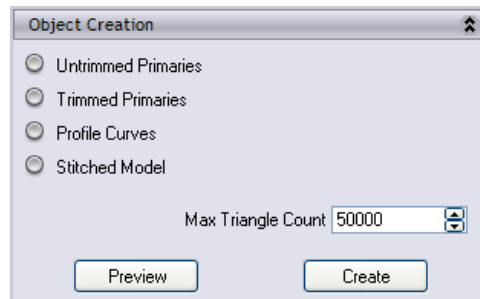
A color map of the fitting can also be generated, indicating the deviation of the fitted surface (or group of surfaces) from the original scanned data. If the fitting process allowed too much deviation, for instance, the user can re-fit selected surfaces with different parameters.

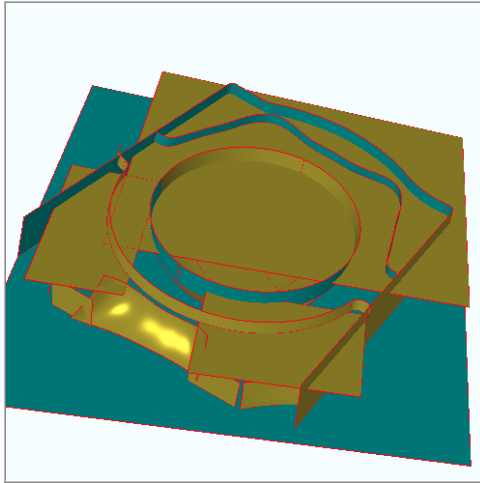


## Trim and Stitch Operation

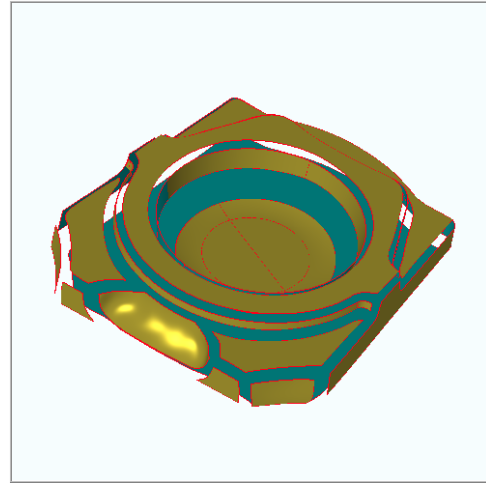
The last operation allows the user to create an object in the Model Manager that is exportable to another CAD system for further design detailing, NC operation, CAE analysis, or rapid prototyping.

**Trim and Stitch** offers four options for the creation of an exportable object:

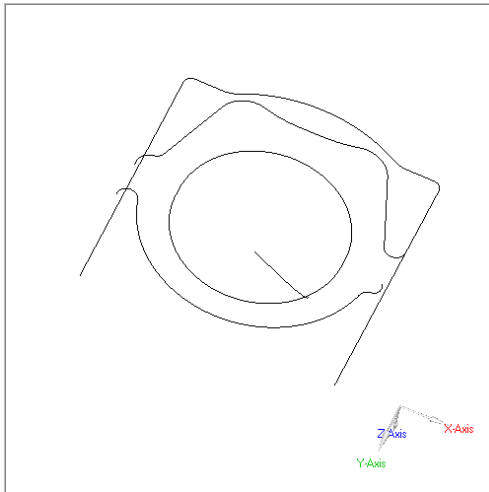




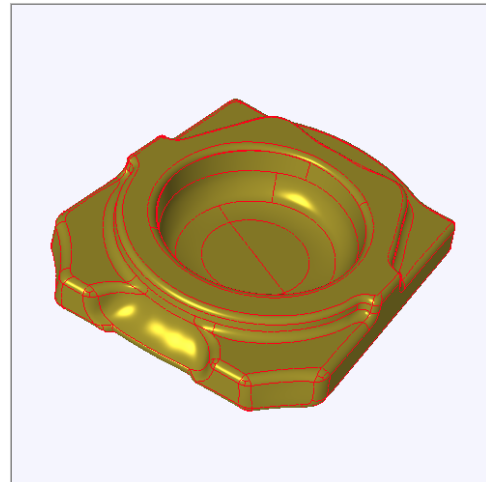
**Untrimmed Primaries** and  
*no connecting surfaces*



**Trimmed Primaries** and  
*no connecting surfaces*



**Profile Curves** (if present in the model;  
these are the 2D profiles upon which  
extruded and rotational surfaces are  
based)



**Stitched Model** - Trimmed Primaries *with*  
connecting surfaces

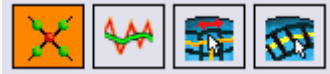
Each kind of output can be exported in various formats such as IGES and STEP, except **Profile Curves** which can be exported as IGES only.

### SHAPE PHASE

---

#### Contours > Edit Extensions - **NEW**

In Fashion Phase, **Contours > Edit Extensions** can be used to edit extended contour structures. When editing extended contours, the available operations are:



- **Edit** – Perform basic editing of the extended contours. With extended contours, you cannot change the structure, only reposition the edit points. Operations include:
  - moving a point
  - offsetting a contour or an extension contour by selecting the curve, and dragging
- **Relax** – In this mode, select a contour to smooth it.
- **Spring Curve** – With this operation, you can select a three-sided corner patch to expand it to four-sided.
- **Cross Curves** – This operation allows you to add cross-curves in the middle of an extended contour.

## STREAMLINED FEATURE FRAMEWORK - NEW

In Studio 10, the **Tools > Features** menu has been overhauled to offer a streamlined workflow.

A Feature is a geometric element of a part, either real (such as a line, plane, or cylinder) or imaginary (such as the intersection of planes, the axis of a cylinder, or the center of a sphere).

The set of Feature types has been expanded and streamlined in one single command. Specifically, every 2D and 3D Feature that could be created in an earlier version of Geomagic Studio can now be created as a Feature. *Datums continue to be supported, but Geomagic strongly recommends the creation of Features instead of Datums in all Geomagic processes.*

In the command dialogs, wherever there existed a dropdown list of an object's Datums, there now exists a combined list of the object's Features and Datums. In other words, Features can be used as if they are Datums. This is true in the following command:

- Tools > Alignment > Datum/Feature Alignment

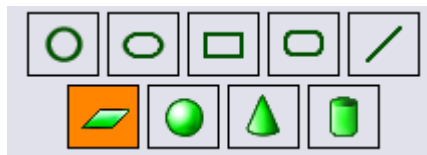
## Tools > Features > Create Features - EXPANDED

**Tools > Features > Create Features** now creates a wider variety of Features that can be used, namely three dimensional features including Cones, Spheres, and Cylinders.

**Benefits:** Provides the ability to create, review, modify and leverage prismatic features through the entire workflow.

The available Features are:

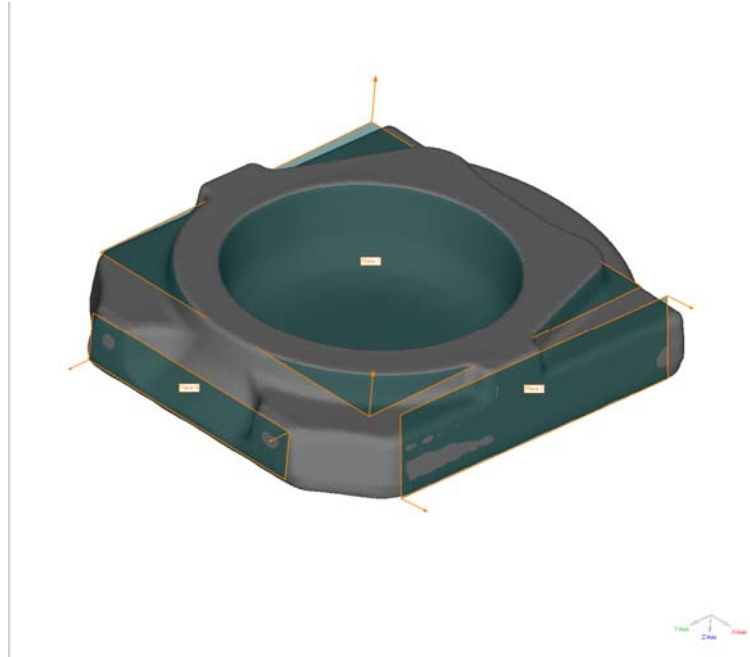
- Circle
- Oval Slot
- Rectangular Slot
- Rounded Slot
- Line
- Plane
- Cylinder
- Cone
- Sphere



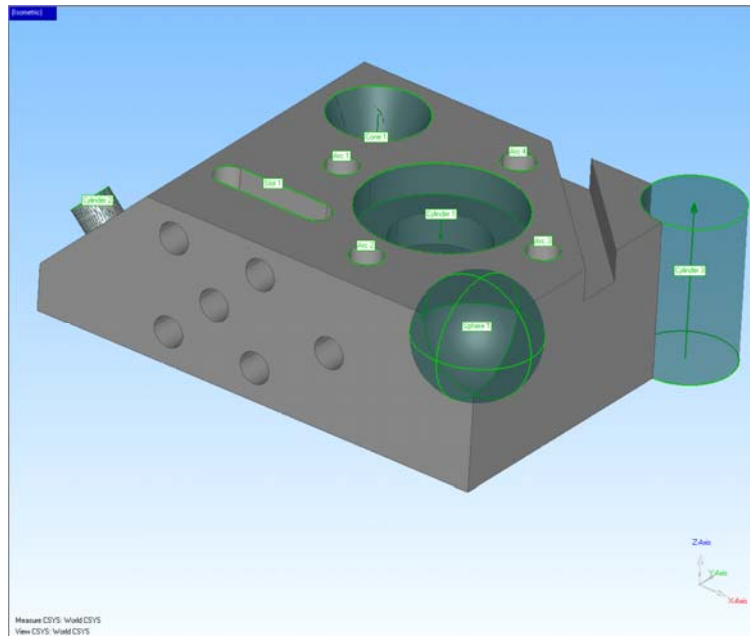
Features can be created by the following methods:

- by selecting from a CAD model (i.e. created in the Fashion or Shape Phases)
- by best fit of a selected area
- by constructing from other Features
- parametrically (such as by position, direction, and radius)

New Features appear on the object in the Viewing Area and in the object's Features sub-folder in the Model Manager.



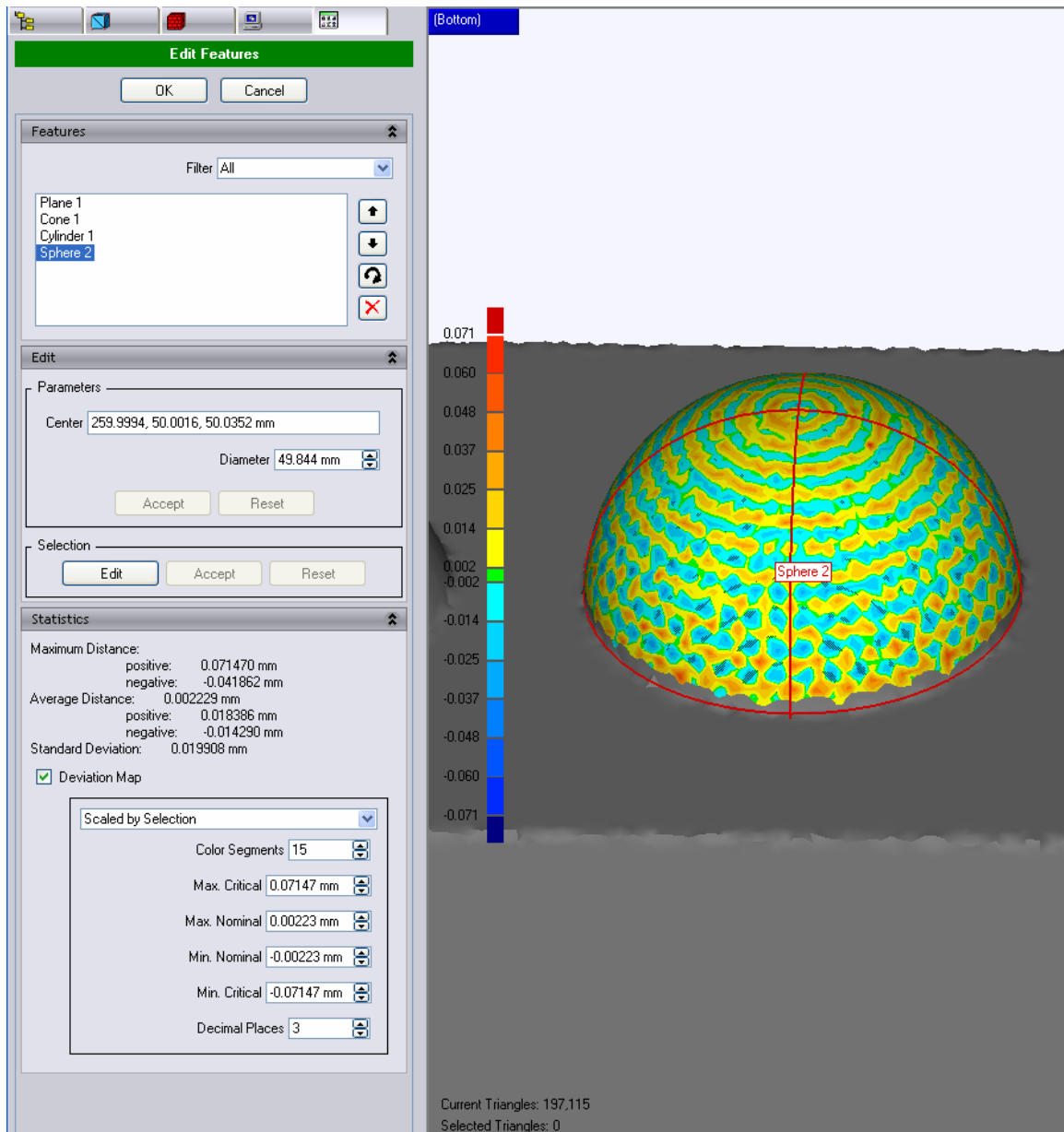
Example of an object with three Plane Features.



Example of an object with a Sphere Feature, two Cylinder Features, six Circle Features, and a Slot Feature.

## Tools > Features > Edit Features - EXPANDED

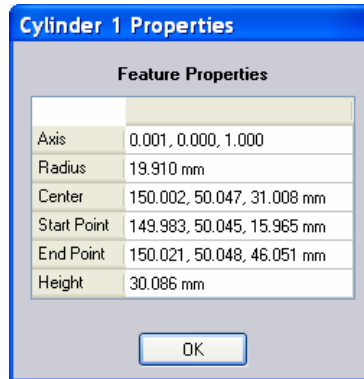
**Tools > Features > Edit Features** now allows review and modification of some parameters of a Feature.



Dialog for **Tools > Features > Edit Features**, showing the parameters (Center and Diameter) of a Sphere Feature, and a “Statistics” section showing color-coded deviation of the Feature from the ideal shape.

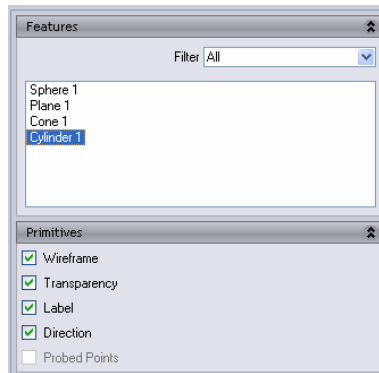
### Right-Mouse Menu of a Feature includes Properties - **NEW**

The right-mouse menu of a Feature in the Model Manager now allows the display of a Feature's properties.



Property set of a Feature, visible by picking **Properties** on the right-click menu of a Feature in Model Manager

### Tools > Features > Modify Feature Display - **NEW**



Dialog of the **Modify Feature Display** command

**Tools > Features > Modify Feature Display** configures the appearance of 3D Features in the Viewing Area. For a specific set of Features, the following can be toggled on or off:

- display of the Feature with wireframe
- display of the Feature label
- control of the Feature translucency
- display of the Feature main direction
- display of probed points

### Tools > Alignment commands - **MODIFIED**

**Tools > Alignment > Datum/Feature Alignment** has been modified to accept all new Feature types. The dialogs are not changed.

## INTEGRATED HARD PROBING

Studio 10 offers two new commands related to hard probing that are built into the Studio application as opposed to being widgets of a plugin.

**Benefits:** The shape capture process is faster and more precise with hard probing, especially when a Test object has out-of-sight Features.

The new commands are:

- **Tools > Alignment > 3-2-1 Alignment with Hard Probe** - establishes spatial orientation of a probing device (similar to the Hardware Alignment widget that is available in the plugins).
- **Tools > Features > Create Hard Probing Features** – creates a Feature while using a CMM portable arm.

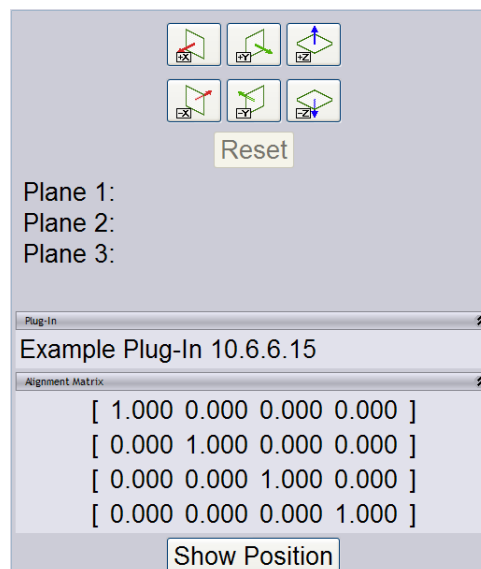
The new commands utilize the software services of a device-specific plugin, so they are functional only when a hard probe device and its plugin are installed. Certain parameters that affect these built-in commands, such as probe size, must still be configured through the plugin.

### Tools > Alignment > 3-2-1 Alignment with Hard Probe - **NEW**

**Tools > Alignment > 3-2-1 Alignment with Hard Probe** (functional only when a hard probe device and its plugin are installed) establishes spatial orientation of a probing device using the 3-2-1 method. You will click three points to establish the position of one plane, two points to establish the position of a second plane, and one point to establish the position of a third plane -- thus the term "3-2-1".

This command is similar to the **Hardware Alignment** widget that is available in the plugins.

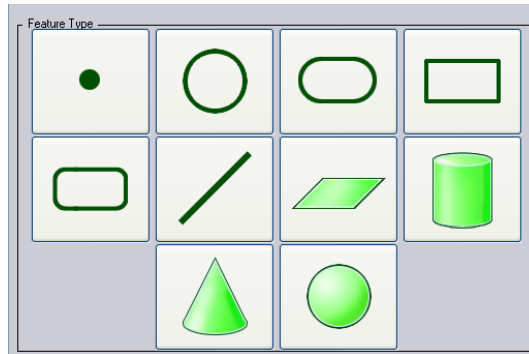
See the Online Help for details and a step-by-step procedure.



User dialog for **3-2-1 Alignment with Hard Probe**

## Tools > Features > Create Hard Probing Features - **NEW**

**Tools > Features > Create Hard Probing Features** allows the creation of new Features by means of hard probing. The Features that can be created are: Point, Circle, Slot, Rectangle, Rounded Rectangle, Line, Plane, Cylinder, Cone, and Sphere.

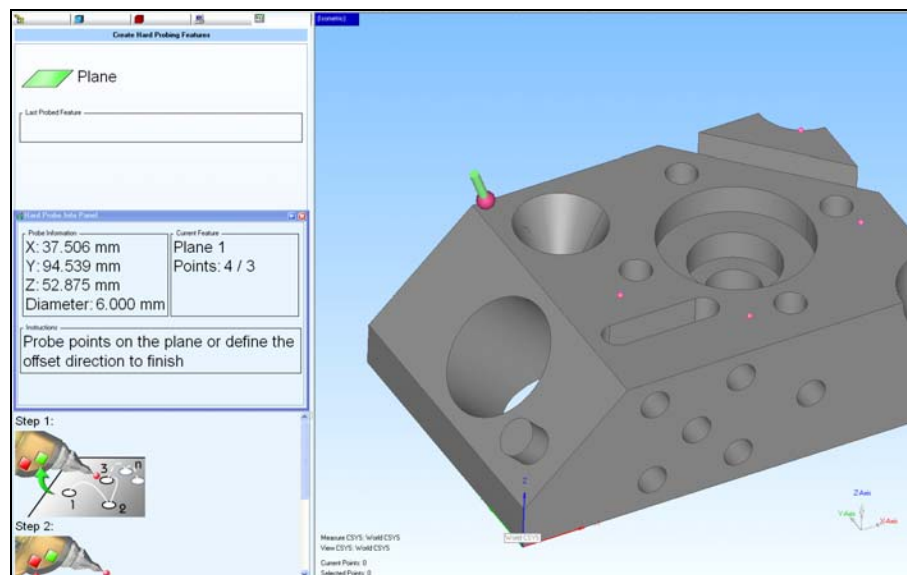


Detail of the **Features > Create Hard Probing Features** dialog, showing the Feature types that can be probed

The Features that can be probed are:

- Point
- Circle
- Oval Slot
- Rectangular Slot
- Rounded Slot
- Line
- Plane
- Cylinder
- Cone
- Sphere

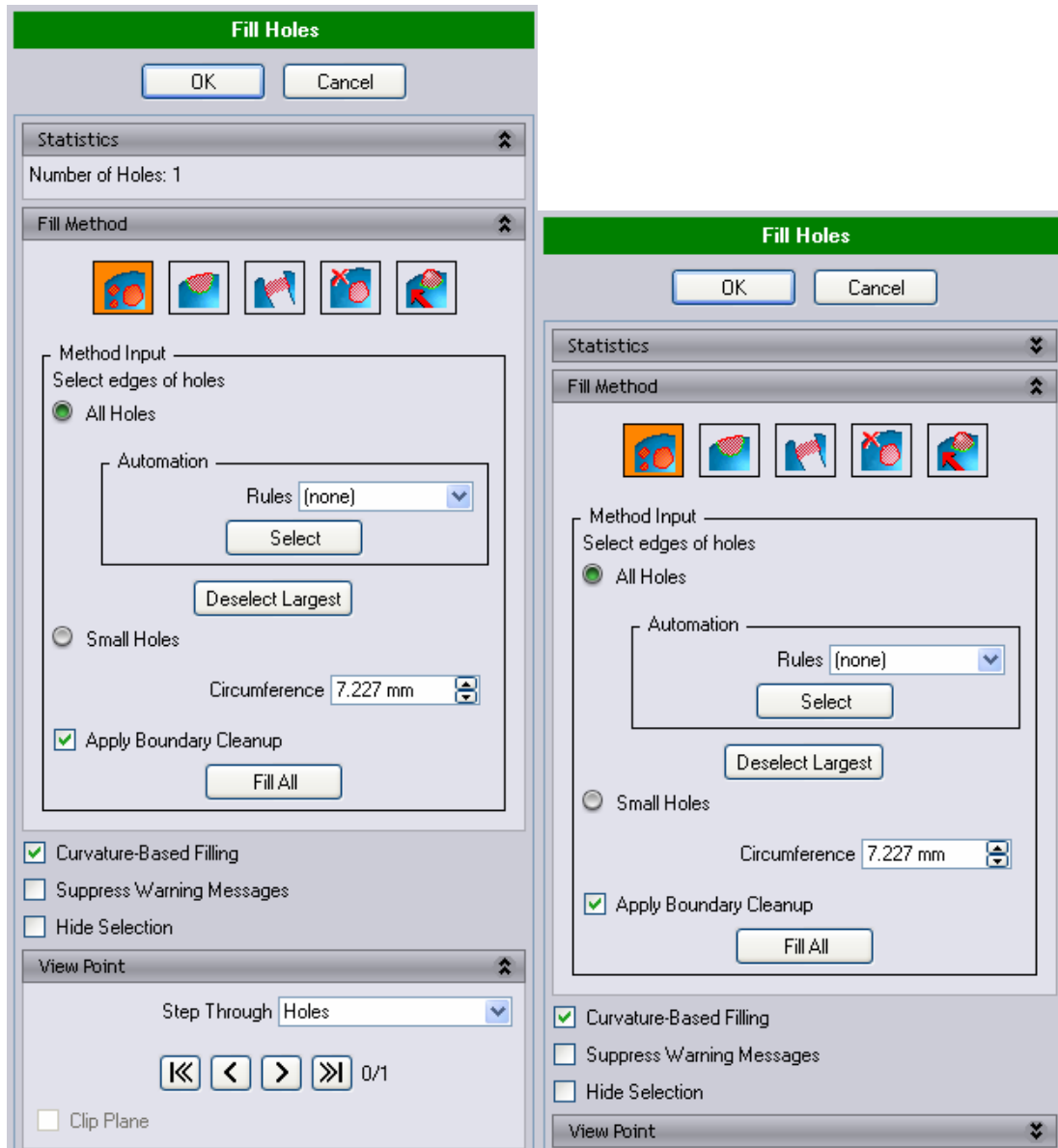
Probed Features appear in the Viewing Area and in the Test object's Features folder in the Model Manager.



Creating a Plane Feature by hard probing

## ENHANCED USER INTERFACE

Geomagic Studio 10 introduces a look and feel that is refreshing, intuitive, and easy to use. The enhanced user interface includes collapsible menus that provide a cleaner, less cluttered workspace, user-configurable display themes, and the use of gradient and drop shadows which provide added dimension and a richer look. Example of the new collapsible menus:



The color scheme of the user interface is configurable at **Tools > Options > General > Themes > Color**, and can be set to the local operating system's default color scheme by clicking **Tools > Options > General > Themes > Use Default OS Color Scheme (XP)**