

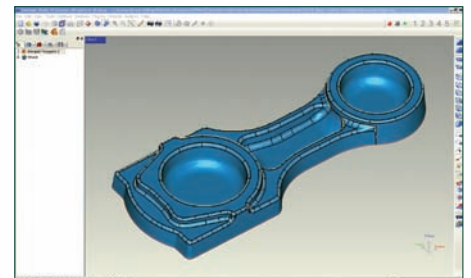
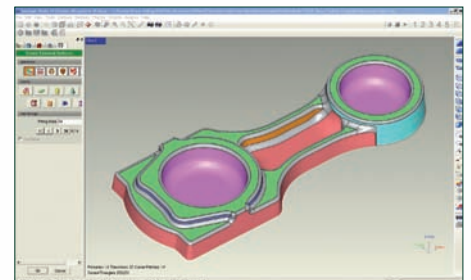
MCAAD

PRODUCT DEVELOPMENT AND MANUFACTURING SOLUTIONS

Geomagic Studio 10

Product Review

Generating
precise forms
from point
cloud data



Geomagic Studio 10

Geomagic uses the tag line “the art of making it simple” - a bold goal in the reverse engineering industry. Al Dean finds out if they can deliver with the latest Studio 10 release.

➤ Before we get onto the ‘meat’ of what’s new in Geomagic Studio, I wanted to spend a few moments to detail some of the generally applicable updates and changes that have been made for this release. For every existing user, the updates made to the user interface are going to strike you first. The system is now much more customisable in terms of UI style. There are presets that will colour and adapt the Studio Interface to match your workhorse CAD system.

In addition, there has also been work done to consolidate the comment structure and make it more usable. The menus are now split into tabs (in a very similar way to NX) and collapsible/expandable features and functions which are used less often can be hidden. But perhaps what is the best enhancement is the consolidation of all manner of similar operations into single panels. For example, rather than there being a separate operation for datums, features etc, they are now available in a single place and work from within a single Features tab. Finally for UI, the system now rotates the 3D model around the cursor. This is not a biggie, but many users requested it (but if you don’t like it you can switch it off).

Another general update is the addition of multi-sen-

sor metrology support, which will be a godsend for those users wishing to combine the strengths of 3D scanners with hard probes. This now allows you to capture a quick scan of an object then use a hard probe to create features such as cylinders, cones, and spheres and measure out-of-sight areas for precise areas shape capture. With this capability it’s not attempting to be a metrology application – but it does pay dividends when creating precise features for alignment and control as it means you can take full advantage of your hardware.

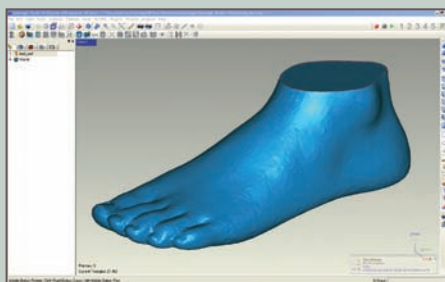
The big news for this release is the launch of the Geomagic Fashion module. This takes the company’s knowledge and existing technology and adapts it to enable the creation of precise surfaces from physical forms that can be used downstream – whether that’s for design modification, for remanufacturing or archiving.

The existing workflows and tools with Studio allow you to get some of the way there, but the system was originally developed to allow you to mimic the physical part, rather than to create ideal surface geometry. Fashion sees this process gap filled – so let’s explore how it works and what it

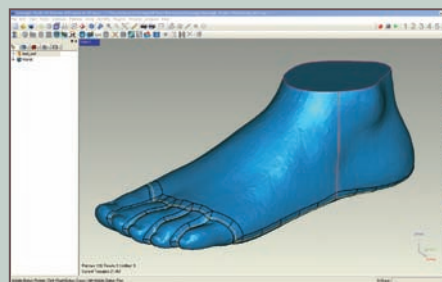
Geomagic workflow

Dual stream workflow which illustrates the two different methods of working with point cloud data and the different results you can achieve based on point clouds (Geomagic Shape) or on explicit surface generation for downstream use in your CAD system (Geomagic Fashion).

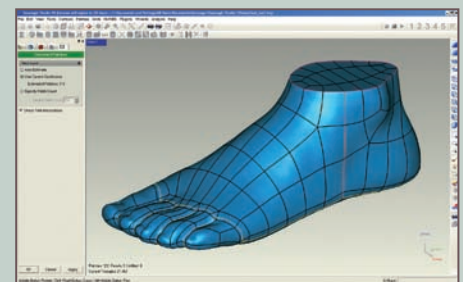
Geomagic Shape workflow



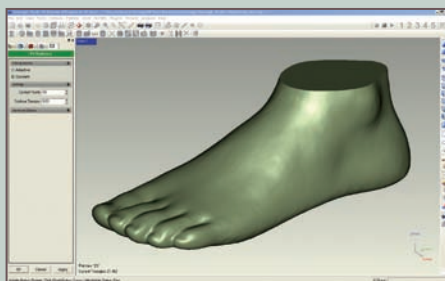
▲ 1. Polygon Scan-data.



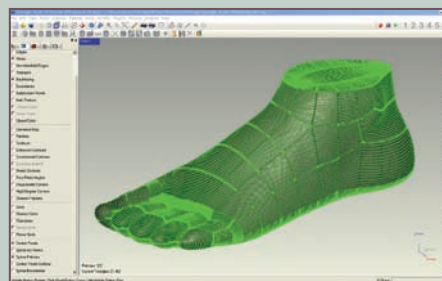
▲ 2. Model Divided into regions according to curvature segmentation.



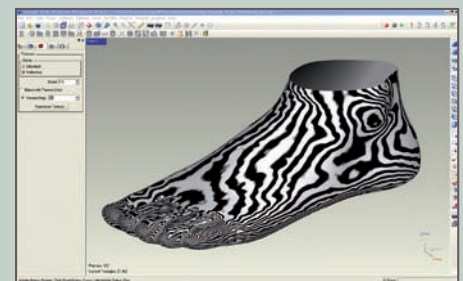
▲ 3. Regions filled with surface patch layout.



▲ 4. NURBS surfaces.



▲ 5. Adaptive control points showing high quality of NURBS.



▲ 6. “Zebra” pattern showing high quality of NURBS.

enables you to do.

Once you have completed the scan cleanup and pre-processing stages you'll have a good quality polygon mesh and will be ready to start working with that to create surfaces. With the introduction of the Fashion module, it's at this point that you're offered a choice of whether to use the existing Shape or the new Fashion tools. Essentially, this depends on the output you're looking for. If you're looking to take the mesh and create a series of CAD-readable surfaces that conform to that shape exactly, with all of the minute details, bumps, dings etc that are typically found in physical parts, then you use Shape. If, however, you're looking to create an explicit set of perfect surfaces that describe a much more precise (in terms of surface quality) version of that physical part, then Fashion is the way to go.

We covered the Shape workflow in a lot of depth in the last review (see www.mcadonline.com), so there's little point in repeating ourselves, so let's crack on with the new goodies.

Fashion is driven from just six buttons, which step you through the process. The first is to Detect Contours. This analyses your part and presents you with a colour shaded display of regions. Whereas within Shape the same process is curvature based, within Fashion the system is looking for design intent through various feature types. Yes, it uses curvature to achieve this, but the goal is that you're looking to colour up each face within your part to identify features on which surfaces can be built.

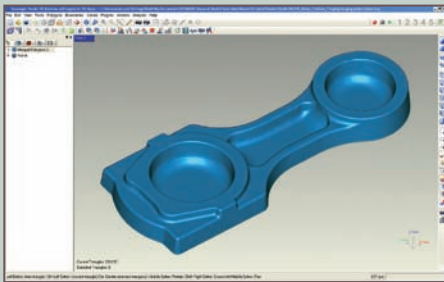
You then move onto classify these regions by intended shape – i.e. what sort of surface you're eventually going to use to recreate that geometry. These include planar, extruded, cylinder, sphere, cones, as well as more CAD-type operations such as extrusions (linear or drafted) and revolves or rotations. Of course, it's common for some complex surface areas to not confirm to these ideals, so these are typically defined as freeform. These regions are defined by colour

and you adjust them simply by painting the polygon triangles to change their assignment and segmentation. Once you're happy with the results, the system performs a few checks to ensure that there are no problems such as intersections, misplaced vertices or disjointed curves within the contour curves. The systems will also flag a warning if any of the underlying polygons are likely to cause problems with any of the surface creation functions.

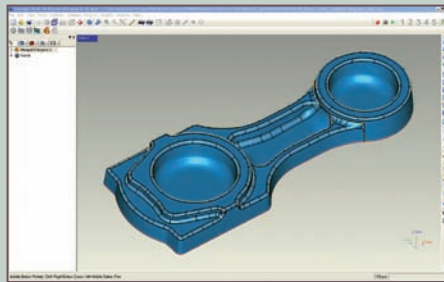
Next up is the process of sub-dividing your polygon mesh, which creates a series of curves at the intersection between the regions you previously created. These essentially define the trimming boundaries for your surface geometry and as such, attention needs to be given to ensure that they're as clean as possible. Because the system is creating the curves from a faceted mesh, you're going to need to adjust them, smooth and remove control points, or even straighten some sections. The goal is a network of clean, high quality curves and it's readily achievable using direct manipulation of the geometry. Once done, the system performs a check to ensure there are no cross-over conditions (which can result in twisted surfaces).

So far this is similar to the existing Shape workflow (greatly enhanced curve creation/extension/editing functionality for Studio 10), but from here on in, it departs. You can either work with the automatic tools or the manual ones, but the goal is to start to create primitive surfaces that create a match between the physical data and design intent. The explicit surfaces are grouped into a two step workflow – primaries and transitions. Primaries are the major surface types, extrusions, revolves, with or without draft angles. You create the basic surface, and then use the boundaries to trim them. Each surface type has its own controls, so that you can adapt it to meet the geometry or your requirements. The rotational surface is an excellent example - it will find the profile and the central axis that the profile is to be revolved around from

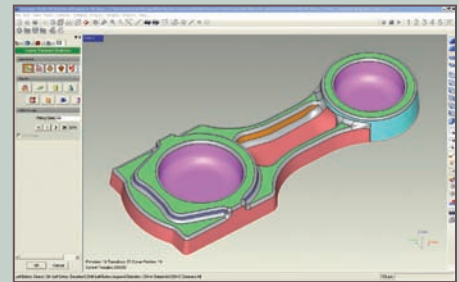
Geomagic Fashion workflow



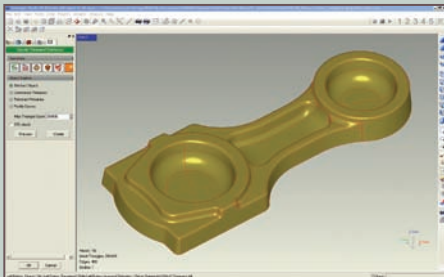
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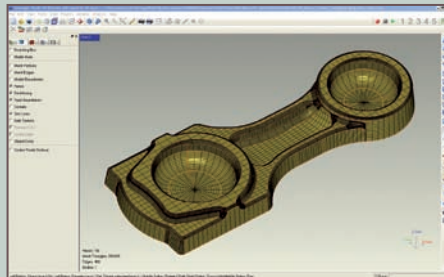
▲ 2. Model divided into regions according to feature segmentation.



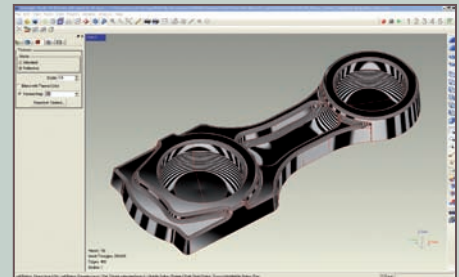
▲ 3. Regions by classification for optimised, modifiable surfaces.



▲ 4. Stitched CAD (or trimmed/untrimmed surfaces) generated.



▲ 5. ISO lines showing high quality of CAD model exported.



▲ 6. "Zebra" pattern showing high quality of CAD model exported..

the geometry you've identified. Both can be adjusted to your intent, which is particularly critical if you're working across a symmetry plane. There are also fitting parameters in terms of normal, tolerance and it also allows you to apply concentricity to other cylindrical features.

Freeform gives you a lot of control over how it's built and Edge labelling allows you to adjust how a patch is built. For example, say you have a car wing, you could slap a surface on it and it allows you to control how the iso-lines are constructed and built to the reference you want – rather than settling for what the system gives you. It's essentially using the guidance you give it to construct the surface patch.

Secondary Surfaces cover things like fillets and chamfers or points where you're looking to create a blend between two or more surfaces. This handles two surface blends with ease and some tricky situations between three surfaces but it won't allow you to specify fillet radii or chamfer dimension

- it just creates the surface. The work around is, of course, to create your primary surfaces in Fashion, then export the surfaces to your CAD system, then use that to create those specific features – it's what it's built for after all.

Whilst you are defining these surfaces and their trimming boundaries, the system also provides you with live tools to inspect and visualise the quality of the data you're creating, in terms of in its own right but also in comparison to the point cloud on which its built.

Once done, the end result could be one of several things. It might be a network of untrimmed surfaces which you intend to export into your CAD system and trim and merge into a solid, or a watertight solid where you have all the surfaces defined within Geomagic, or a combination of the two. You can even simply output the curves if you're looking to reconstruct the surfaces from scratch in your CAD application. Whatever the result you're looking for, the end result is a geometry set that is much more suited to downstream work within a CAD system.

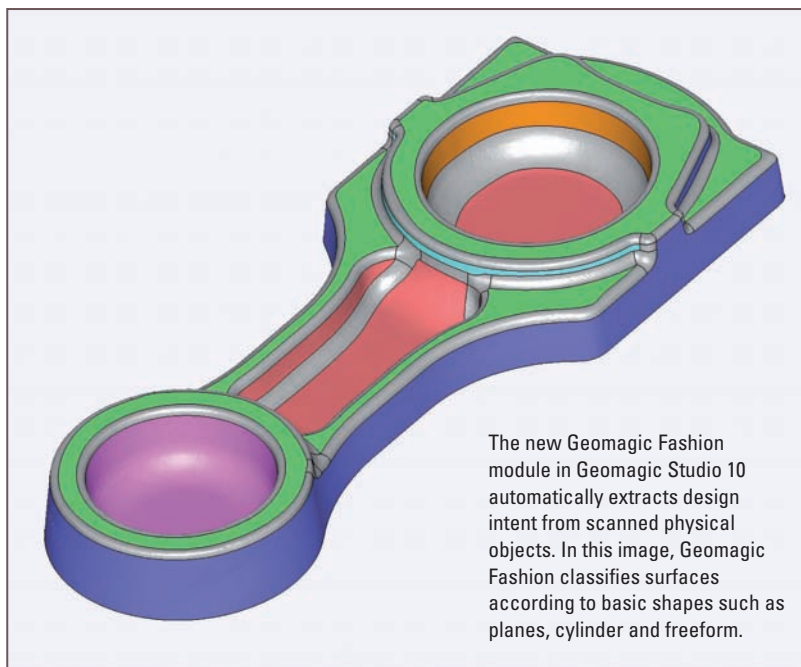
Conclusion

For those that already have Geomagic Studio in house and have the need to get bulletproof, high quality surfaces that replicate design intent rather than pure physical forms, then Fashion is a no-brain acquisition. If you're looking to adopt reverse engineering processes within your organisation, then Geomagic Studio should be on your short list of systems to evaluate – but with the addition of this module the chances are that it can solve all of your workflows in a more efficient manner.

Geomagic is a fascinating organisation, with a rapidly growing portfolio. What interests me most is how the company is taking its ever growing wealth of knowledge and applying it in several ways. Firstly, the company is taking its know-how and applying it to industry-specific workflows such as dental, turbo-machinery, etc. Secondly, it is taking its knowledge of reverse engineering technology and, more importantly, its knowledge of what users are doing with the technology and combining the two into new modules which solve specific problems encountered in many industries. This is self evident with the Fashion module, a supremely impressive addition to the Geomagic Studio offering. Other vendors are spending development resources on providing tools that allow you to create fully parametric models within a reverse engineering application when the fact of the matter is that this really is the preserve of the fully-fledged CAD application - is it not?

To use a cliché, what's the point in reinventing the wheel? The Fashion approach makes much more sense. There is a distinct saving to be made by combining the power of Geomagic's system with your workhorse CAD system. Isn't it better to use a system specifically designed for the purposes of capturing physical data, then using your CAD system to make the modifications and adapt that data to your requirements and workflow? I certainly think it is. ●

www.geomagic.com



The new Geomagic Fashion module in Geomagic Studio 10 automatically extracts design intent from scanned physical objects. In this image, Geomagic Fashion classifies surfaces according to basic shapes such as planes, cylinder and freeform.



In this image, texture mapping shows the high quality of surfaces created using Geomagic Fashion.

PRODUCT	Studio 10
SUPPLIER	Geomagic www.geomagic.com
PRICE	On application