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Reverse Engineering With SolidWorks And Inventor

December 11 - 15, 2006 by **Jeff Rowe**

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Reverse Engineering With SolidWorks And Inventor

Creative DeSign Concepts Inc. announced that DeSignWorks V8.0, a feature-based reverse engineering (RE) software product, supports SolidWorks 2007 and Inventor R11. Engineers and designers use DeSignWorks and SolidWorks or Inventor to capture data from existing parts directly within their respective design environments, maintaining the associativity so they can design better products faster and more accurately, speeding time to market.

Creative DeSign Concepts Inc. just introduced another industry first to DeSignWorks V8.0. DeSignWorks has the ability to capture data directly from a digitizer device to SolidWorks ScanTo3D. With DeSignWorks patent-pending data collection method all the movement of the device is stored and can be reused again and again with out the need to re-digitize the model. During the digitizing procedure the data can be exported and used to compare the information to an existing model or imported back into SolidWorks to create a mesh with SolidWorks Scan to 3D. Additional new capabilities have been added for capturing 2D/3D points and saving the data to a file structure (.csv) and reading the data back into SolidWorks to compare multiple model data such as chassis suspension points. For a complete list take the DeSignWorks Test Drive.

A SolidWorks Certified Gold Product, DeSignWorks enables users to perform reverse engineering functions directly inside the SolidWorks interface and create feature based models utilizing digitizer devices such as Faro, Romer and MicroScribe. DeSignWorks in conjunction with SolidWorks 2007 expands on the software's legacy of ease of use, design power, and affordability by also providing users with comprehensive drawing tools and new productivity features that will speed the adoption of 3D design around the world. DeSignWorks gives engineers the functionality to capture data from their existing part and create an intelligent feature based model, allowing the engineer to make changes rapidly while preserving the associativity to the part. DeSignWorks can be used in a part or an assembly.

"Engineers shouldn't have to move between 2-3 different applications to finish a product design," said Brian Houle, Partner Program manager for SolidWorks. "Integrating DeSignWorks with SolidWorks means engineers can begin reverse engineering their existing parts directly within the SolidWorks environment. That saves time and helps manufacturers meet tight production deadlines. SolidWorks gives engineers the tools they need to work more efficiently. That is why SolidWorks leads the market for mainstream 3D mechanical design software."

"SolidWorks is the standard for 3D mechanical design software," said Houle. "Combining it with DeSignWorks gives engineers the tools they need to do their jobs faster and better by performing reverse

engineering functions inside SolidWorks, creating intelligent data that conforms to SolidWorks and allows engineers to make changes to the data. Complex shapes can be captured quickly and accurately. DeZignWorks is the only product of its kind that has the ability to randomly move the digitizer across the surface of the part and store the movement of the digitizer device for immediate use or at a later determined time. New or existing data can be added and simply reloaded into the database, automatically generating new data for Scan to 3D. Because of its depth of integration to the SolidWorks interface engineers are productive in a few hours.

A recent study estimated that 80% of new designs came from existing designs, usually an existing part. Utilizing DeZignWorks a feature based product instead of a point cloud product gives the engineer the ability to capture the exact shape, even complex surfaces, directly inside the SolidWorks interface and then make changes rapidly to meet the needs of the new products and improve the design for the ever changing market needs. DeZignWorks offers best-fit capabilities for lines, arcs, circles and splines. DeZignWorks offers several utilities for curve editing such as maintaining minimum distance while capturing complex curves as well as spline uniformity tool.

Creative DeZign Concepts also announced that DeZignWorks V8.0 now supports Autodesk Inventor 11. Creative DeZign Concepts demonstrated DeZignWorks V8.0 for Inventor 11 last week at the 19th Annual Performance Racing Industry show in Orlando, FL. DeZignWorks known as a solution for feature based reverse engineering for SolidWorks now brings its patent pending technology to Inventor 11 as an AutoDesk Inventor development partner.

Commentary By Jeffrey Rowe, Editor

Earlier this autumn I had some hands-on experience with DeZignWorks and SolidWorks Office Premium 2007. I undertook the experience because in many peoples' minds, reverse engineering is the illegal act of copying, in effect stealing, an original design, in this case a physical object. That old perception and definition is something I wanted to help dispel with a more positive image based on my experience.

Reverse engineering is a process for digitally reconstructing a physical part. This is significant because recent estimates are that up to 80% of new designs come from existing ones, usually from existing parts and assemblies. Reverse engineering is part of a larger scheme becoming known as digital shape sampling and processing (DSSP), involving several technologies that together bridge the physical and digital worlds.

Many potential users wrongly assume that reverse engineering technology is beyond their financial means. However, you might be pleasantly surprised to discover that it is available as an affordable desktop package to small- and medium-sized businesses. Depending on the scanning technology employed, you will find an entry-level price point in the \$15,000-\$20,000 range, and that includes all the hardware and software needed for getting started in reverse engineering.

Although there are several digitizing technologies available today (each having its own distinct advantages and disadvantages), I'll focus on scanning with contacting (mechanical touch probe) feature-based instruments, because that's what I had available to me. Regardless of the particular method chosen, scanning provides you with something to start with as a vital digital part of the overall reverse engineering process.

Feature-based scanning using a touch probe is a method where features of an object are scanned by physical contact. A mechanical touch probe, also known as a contacting digitizer, is a physical part contact device and method well-suited for prismatic objects, such as machined parts.

Touch probes, are typically very accurate over a wide measurement volume. There are contact digitizers that are positioned manually to yield a single measurement at a time, or may be scanned across a surface to produce a series of measurements. Contact instruments usually employ an articulated arm that allows for multiple degrees of freedom of movement. The position of each section of the arm is determined by encoders or potentiometers mounted in each joint.

Manually positioned devices can make it easier to get at areas of an object that can be difficult to digitize,

such as small holes, narrow slots, or deep pockets. One of the biggest advantages that feature-based scanning has is the fact that with the proper intermediary software, the data derived from the scanning provides more control and can often be used directly for parametric modeling, and not just referenced. In feature-based scanning, basically, you can randomly scan sections of a part that are automatically turned into lines and splines for creating a digital surfaces and solids.

An example of a feature-based scanner, and the one I used, is Immersion Corp.'s MicroScribe MX measurement system. It is both portable and affordable, and is available in 5 or 6 degrees of freedom, is accurate to 0.002" (0.0508 mm), and its articulated mechanical arm has a reach of 25" (.63 m). The touch probe is somewhat like a paint brush or laser in that you can scribble on an object and store the data of the articulating arm's movement.

DezignWorks software serves as a driver and interface between the MicroScribe MX (or other feature-based scanners) and SolidWorks or Inventor, transforming the scanned feature data directly into a solid model within SolidWorks or Inventor. It also works with laser scanners, but only feature-based scanning will be discussed here. DezignWorks creates native data that is parametric and ready to use in SolidWorks or Inventor. In fact, the data can come into SolidWorks or Inventor with sometimes little, if any, clean up required.

DezignWorks captures data directly from the MicroScribe MX as the touch probe moves randomly across, stores the movement of the touch probe, and transfers it to SolidWorks. During the digitizing procedure, the data can either be used to compare it to an existing digital solid model, or imported into SolidWorks to create a mesh for creating a digital solid model with ScanTo3D (a new capability found in SolidWorks Office Premium 2007). New or existing data can be added and reloaded into the DezignWorks database, automatically generating a new dataset for ScanTo3D. The Dezignworks software has best-fit capabilities for lines, arcs, circles, and splines. It also has several utilities for curve editing, such as maintaining minimum distance while capturing complex curves, as well as spline uniformity.

A simplified workflow for the feature-based scanning and data manipulation process consists of the following products for performing the basic steps: MicroScribe MXàDezignWorksàSolidWorks (or Inventor).

When you start a new part or assembly in SolidWorks, the Dezignworks toolbar is displayed that has four groups of tools that you will use to ultimately transform a feature-based scan into a SolidWorks solid model.

The touch probe is used to scan (digitize) the outside contour of a part. Select the Front plane and start a sketch. On the DezignWorks toolbar, select the Line tool and the type of compensation you want to use based on how you will be moving around the part to capture points during the feature-based scanning process. Like a sketch, you see lines of the contours being generated as you re-position the touch probe from point to point. When you have digitized the entire outside contour of the part, use SolidWorks' Trim/Extend tool to create a closed contour.

Next, extrude the 2D sketch into a 3D solid using the Extrude tool on the DezignWorks toolbar. Move the touch probe to the top of the part and capture data based on the position. You have just created an extruded boss that is the height of the physical part. By scanning other features on the part, you can now create cuts, such as holes and slots. These features are created on your model from the scanned data using various tools on the DezignWorks toolbar, such as 2D Geometry (line and circle) and 3D Geometry (extruded cut).

You continue this process for digitizing features until all of them have been scanned, manipulated, and digitally transformed into a native, 3D feature-based SolidWorks solid part model. It really is as simple as that.

Although my experience so far with relatively simple reverse engineering using DezignWorks has been with SolidWorks, I suspect that the experience with Inventor would be largely the same. However, I'd like to test that statement out before committing to it. In any case, I found the reverse engineering techniques using DezignWorks to be comprehensive, straightforward, and, ok, fun. What a good way to end the year.

The Week's Top 5

At MCADcafé we track many things, including the stories that have attracted the most interest from our subscribers. Below are the five news items that were the most viewed during last week.

[Audi Sports' Winning Le Mans Diesel Engine Developed With PTC Software](#)

PTC announced that **Audi Sport**, the motorsports division of **Audi AG**, will shortly complete its 11th consecutive year of motor sports partnership with PTC. Audi Sport deploys PTC's Product Development Solution - including **Pro/ENGINEER** and **Windchill** - to develop its winning race cars for both the German Saloon Masters, as well as the program with the Sport Prototype, including the "24 Hours of Le Mans." **Windchill PDMLink** has been deployed to capture and manage all product development information to increase engineering productivity for the Audi Sport development teams. It also enables collaboration between the Audi Sport team and the Audi brand group as part of their ongoing technology transfer.

[Dell Precision M90 Features NVIDIA Quadro FX 3500M](#)

Engineered to deliver performance, the **Quadro FX 3500M** with support for OpenGL and DirectX, offers up to 512MB G-DDR3 memory, a 256-bit memory interface, up to 38.4GB/s memory bandwidth and up to 2GB/s pixel read back. The Quadro FX 3500M includes adaptive power management tools for performance scalability and visualization of the most extensive datasets at the highest image quality. This new Quadro FX graphics solution is available immediately as an option on the Dell Precision M90 system, the most powerful mobile workstation ever offered by Dell, for an additional \$399. The **Dell Precision M90** features Intel Core 2 Duo processors, large memory configurations, 17-inch displays, and can be configured with 32- or 64-bit Microsoft Windows XP Professional.

[UGS Extends Mechatronic PLM To Software Lifecycle Management](#)

UGS Corp. announced a partnership with **Telelogic** that has resulted in the PLM industry's first integrated solution for managing the complete lifecycle of software content. This "software lifecycle management" solution -- the result of the integration between **Teamcenter** software and **Telelogic Rhapsody** software - extends Teamcenter's mechatronic PLM capabilities to include software development. Telelogic enters the UGS Partner Program as a Foundation partner. The new Teamcenter-Rhapsody solution integrates the Unified Modeling Language (UML) with PLM. This brings together requirements and lifecycle management with software systems design and automated code development, thereby extending UGS' solution set for managing the complete lifecycle of electro-mechanical software product definitions.

[2007 CoCreate OneSpace Suite Announced](#)

CoCreate Software announced its next major release, the **2007 CoCreate OneSpace Suite**, available in early 2007. The 2007 CoCreate OneSpace Suite is a comprehensive product development platform for PLM. Using a lightweight approach (versus a monolithic system) CoCreate leverages customers' existing IT investments in upfront product planning and downstream manufacturing systems to create an interconnected enterprise. CoCreate's solution complements ERP systems -- rather than competes with them -- and is termed "3rd generation PLM" by the company. The path to 3G PLM starts with CoCreate's Dynamic Modeling based approach to 3D product development. The 2007 CoCreate OneSpace Suite is tuned for companies that must adapt to unpredictable change and new requirements throughout the product development cycle. Allowing companies to rapidly learn and respond in fast-paced markets has propelled CoCreate to its position as a provider of history-free modeling.

[The IntelliCAD Technology Consortium announces IntelliCAD 6.3 beta](#)

The IntelliCAD Technology Consortium (ITC) announced the beta version of IntelliCAD 6.3. **IntelliCAD 6.3** uses the latest advances in the Open Design Alliance (ODA) DWGdirect 2.1.1 libraries, based on the industry standard OpenDWG, which is widely supported by commercial software vendors, and the engineering community. IntelliCAD 6.3 utilizes the new ODA libraries to enable reading and writing of the DWG 2007 file format. IntelliCAD will read, display, and write DWG 2007 files that include the 10 new 2007 entity types and over 80 new system variables. Although the focus was on DWG 2007 compatibility, a few major enhancements can be found in this release, including:

- Improved user interface for PDF export provides more flexible output options.
- Dozens of new events and a new ApplicationPreferences object were added to the COM API.
- A new Set Language command allows you to convert drawings or set your code page language preferences when opening drawings.
- Multiple enhancements for raster image handling.

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This Week

Lead Story

- [DezignWorks Brings Intelligent Reverse Engineering Capabilities To SolidWorks 2007](#)
- [DezignWorks Brings Reverse Engineering Capabilities to Autodesk Inventor 11](#)

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- [Dassault Systemes' New Aerospace And Automotive Solutions Speed PLM Deployment](#)
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- [Perceptron Works With Dassault Systemes To Anticipate Potential Manufacturing Glitches](#)
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- [Dassault Systemes: Third BPC Release For PLM Deployments For Any Size Company](#)
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- [Seemage Appoints Rikei Group As Distributor](#)
- [Delcam To Launch New Version Of ArtCAM](#)
- [CollabraSuite 5.0, BEA Edition Released](#)

- [Centric Software Joins IBM's Product Development Integration Framework](#)

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Corporate Moves

- [Surfware Welcomes New CEO](#)
- [Industry Printed Circuit Board Manufacturing Expert Joins Mentor Graphics](#)
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Industry Events

- [Registration Begins For 2007 NAIAS Automotive Education Day](#)
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- [2007 NAIAS Presents Cutting Edge Automotive Designs And Technology](#)
- [MEDUSA4 Live Webcast - 06 December 2006](#)
- [Less Than A Month Remains To Submit An Extreme Redesign For CAD Students](#)
- [Agile Hosts Customer Summit In San Jose, California](#)
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- [ESI Group Profiles CFD-FASTRAN at 45th AIAA Aerospace Sciences Meeting](#)
- [Webinar: Powerful Flow Simulation for Oil & Gas Separation Technology](#)
- [STHENO/PRO Live Webcast - 07 December 2006](#)

- [One-Size "Search" Does Not Fit All: Dec. 12 Webinar on Search Issues for Mfg, AEC](#)

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-- Jeff Rowe, MCADCAfe.com Managing Editor.

Rating: ★★★★★



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