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## Solid Edge Version 18:

Now part of the UGS Velocity Series, Solid Edge V18 adds tightly integrated cPDM with Teamcenter Express, Femap Express for analysis, Wire Harness Design, Electrode Design, plus more

This report reviews and comments on the major changes implemented in Solid Edge V18.

October, 2005  
Author: Raymond Kurland, TechniCom, Inc.

# Executive Summary

## Introduction

In early September 2005, the author of this report, Ray Kurland, traveled to Solid Edge headquarters in Huntsville, AL to preview the product enhancements found in Version 18 of Solid Edge. Ray met with Solid Edge executives Bill McClure, Dan Staples, and Adrian Scholes as well as application Engineer Mark Thompson, who demonstrated and explained the features of V18. Upon his return, he reviewed his findings with the rest of the TechniCom staff, combining our talents to produce this report and our conclusions.

For this release, Solid Edge becomes part of the UGS Velocity Series, which adds two enormously exciting applications from the UGS software portfolio, specially tailored for mid-market customers and tightly integrated with Solid Edge V18. The two applications, Teamcenter Express and Femap bring the power of high-end solutions to the mid market.

Teamcenter Express expands Solid Edge's already industry-leading PDM capability supplied by Insight into the next level of PLM, supporting medium-sized companies with global operations. Different from its competition, Teamcenter Express maintains the ease of use and ease of installation that Solid Edge customers expect. It does this by offering a preconfigured version of Teamcenter providing collaboration across multiple departments and over multiple sites with support for multiple CAD systems and additional workflow capabilities to manage product release and ECOs. Insight, on the other hand, is a pre-defined solution for single site workgroups using Solid Edge.

UGS's acquisition of Nastran source code two years ago from MSC Software allowed the company to couple this world-class finite element solver with Femap, their preeminent FEA (finite element analysis) pre and post processor to deliver the results. Femap Express, included with core Solid Edge, provides linear and modal single part stress analysis is part of core Solid Edge. For those needing higher end FEA, Femap is more tightly integrated with, and now fully associative with Solid Edge V18.

In addition to these two significant additions from the UGS Velocity Series, Solid Edge continues to add major functions and enhancements. For Version 18, new applications include Wire Harness Design, aimed at enhancing the ability to complete an electromechanical digital mockup and improve manufacturing; and Electrode Design, offering a step by step method with

special functions for the design of EDM electrodes. Additional functions offered in Solid Edge Version 18 include Diagramming, for producing 2D diagrams that are widely used for hydraulic and electrical control systems; and Engineering Reference, for creating parametric parts from engineering calculations.

This paper reviews many of the new aspects of Solid Edge V18, introduces the reader to the new functionality of V18, briefly describes the other members of the UGS Velocity Series, of which Solid Edge is a core component and provides our impression of the new version.

The following sections describe the major functions of Solid Edge V18 that we reviewed. The functions described below are:

- Femap Express
- Wire Harness Design
- Electrode Design
- Diagramming
- Engineering Reference
- Teamcenter Express integration

Our conclusions are discussed in each section and summarized at the end of this document.

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# Description of the new functionality of Solid Edge V18

## Summary

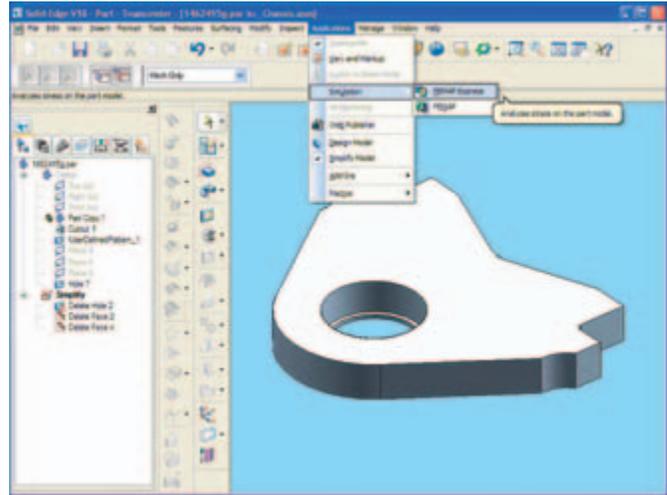
During our visit we asked Solid Edge personnel to focus on those aspects of Version 18 that they considered most important. For each of these primary areas we worked through sample problems, the software being operated by a skilled Solid Edge application engineer - Mark Thompson. This allowed us to observe the operation of the software, the user interface, and to get an overall understanding of the operation of these primary functions. During these demonstrations we took copious notes and captured explanatory screen shots. Since this is a very visual business, we have included the more explanatory of these screen shots below to expand on the text. We trust this enables the reader to obtain an introductory "feel" for the functions. We have also posted more images on our web site at <http://www.technicom.com/SEV18>. We hope that these descriptions whet your appetite for seeing more details of the software. To do so, please contact your appropriate Solid Edge representative or reseller. Solid Edge contact information is at the end of this paper. You can also contact the author with feedback at [rayk@technicom.com](mailto:rayk@technicom.com).

## Femap Express

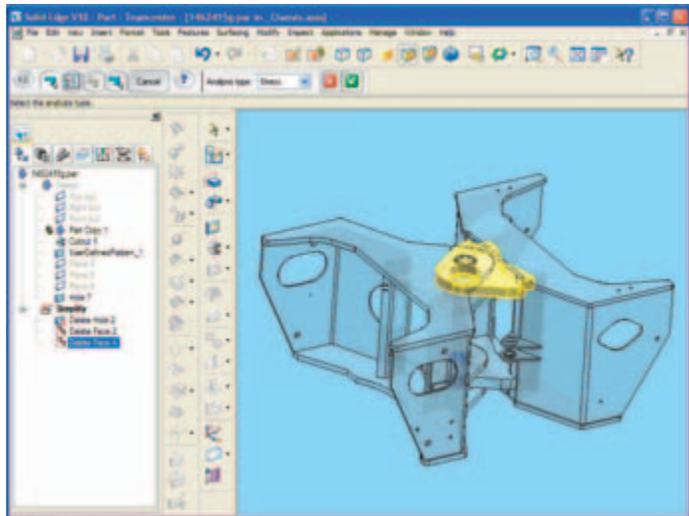
*Femap Express provides a tightly integrated linear stress and modal FEA solution for single components within Solid Edge.* To demonstrate its capabilities, we selected a product to analyze, and then selected the specific part within the product. We zoomed in on the part, activated it, and then activated the Femap Express application.

We had the option of using the detailed design representation or the simplified representation, which often reduces unnecessary detail that has no bearing on the FEA results. We chose to use the simplified representation. With the Solid Edge SmartStep ribbon bar guiding us we sequenced through the required steps to perform a successful analysis. We added a pressure load and the desired constraints where the part was fixed. After accepting the standard mesh parameters, we selected the option to perform a stress analysis, selected the part material from the library, which in our case was steel. Working in the context of the assembly let us use other components in the assembly to constrain our part or to set the force direction. The complete computation including meshing and analysis took less than one minute for the part shown below. We were able to easily visual-

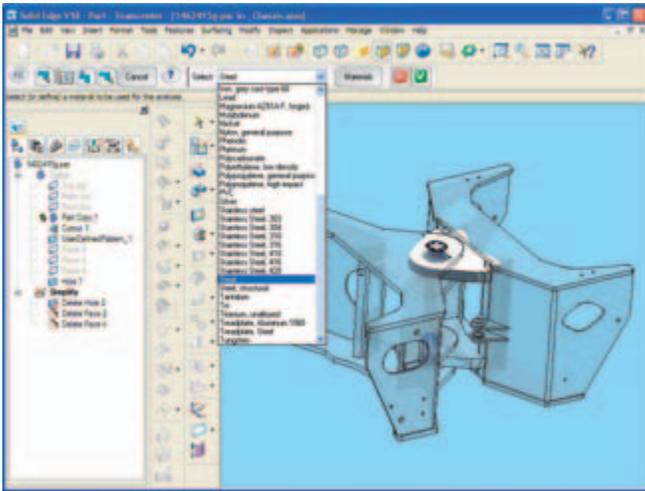
ize the output by examining displays of the results for stress, displacement and factor of safety. An HTML file could be created automatically to document the results generated.



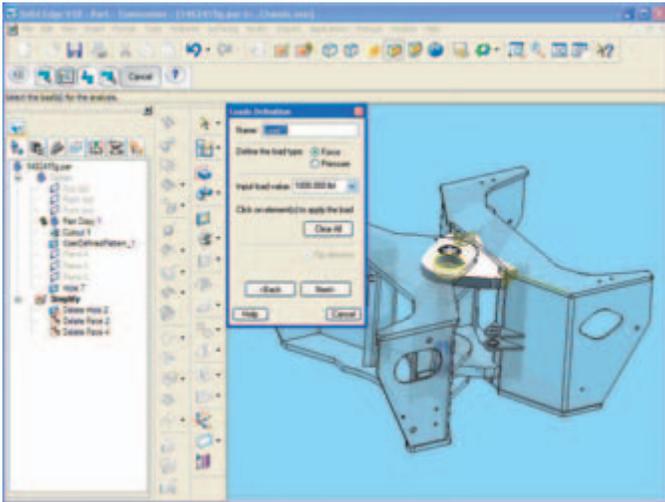
*After activating this part, select Femap Express from the Application menu*



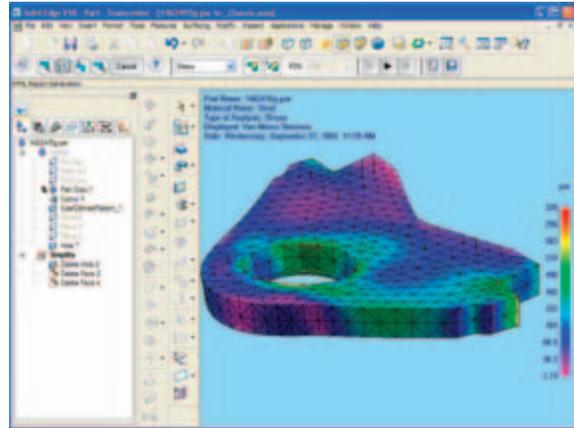
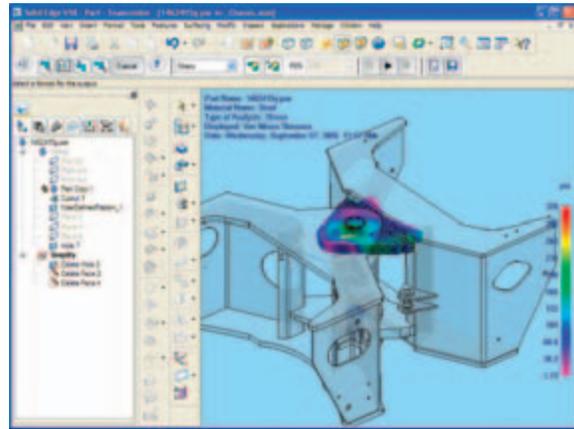
*Note the SmartStep ribbon bar, under the main toolbar, providing step by step guidance. We used the simplified representation of the part to run the analysis. The part is shown in yellow and the assembly to which it is connected is translucent and may be used to establish boundary conditions.*



The material selection step allows the user to select the material from a comprehensive library. Note how selecting the material step expands the edge bar to include the pull down menu for the material.



Now we apply the loads and constraints. In this case selecting a pressure on the upper face. Not seen here, constraints are applied in a similar fashion.



These contour plot images show one example of the analysis output. Others include HTML reports, animation, and deformation display.

Femap (not Femap Express), another new offering of the UGS Velocity Series, offers extensive finite element analysis (FEA) capabilities above and beyond Femap Express, such as non-linear analyses and analysis of assemblies. Femap transfers geometry directly from Solid Edge and maintains associativity in case of future modifications to the Solid Edge geometry. Femap now combines UGS's widely accepted pre- and post-processing capabilities with the UGS Nastran code. While the Femap software is outside the scope of this paper, as might be expected, it appears to be quite extensive in its finite element capabilities. Activating the Femap application from within Solid Edge transfers all material properties and colors along with the Solid Edge model.

## Wire Harness Design

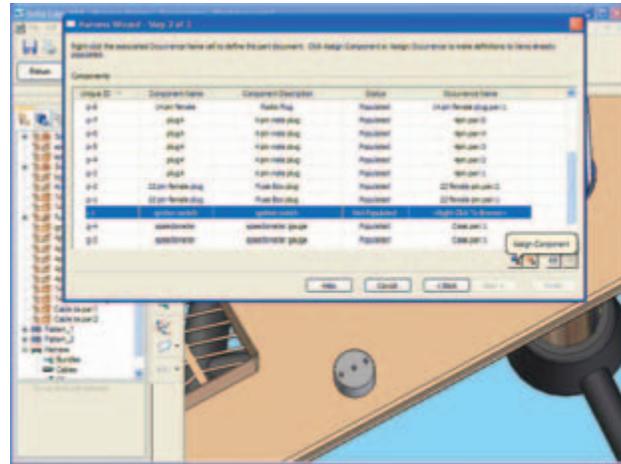
Wire Harness Design, a new add-on application for Solid Edge Version 18, solves the dilemma of resolving mechanical design space orientation with electrical circuit design (eCAD) connectivity orientation. Formerly part of XpresRoute which now focuses on piping and tubing, Wire Harness Design now has substantial additional ability.

Wire Harness Design provides functionality for fully

automated harness design where a net list file is available and manual intervention for wire creation and harness design for those without access to electrical wiring and design packages. Data is transferred between eCAD software and Solid Edge, providing the creation and control of physical cable, wire paths and routing. Net-lists, components, and connections transfer from eCAD to Wire harness Design. Solid Edge can automatically complete the physical cable, wire paths and routing to achieve a complete digital mockup. Output reports with cable and wire cut length and attributes (allowing for a slack percentage and wire stripping) provide manufacturable designs.

Wire Harness Design allows placing and routing cables and bundles which are easily edited using Solid Edge's highly flexible blue dot technique for moving and relocating the wire and cable paths, placing wires and harnesses, and grouping wires into harnesses.

A demonstration of Wire Harness Design showed that it is easy to create point-to-point wires, with the system allowing the user to control the wire direction at start, intermediate, and finish points. A Wire Harness Design wizard provides a smooth interface for reading components and connections from an eCAD system, as well as resolving any missing components or connection details or incompletely specified mechanical information between the two systems.

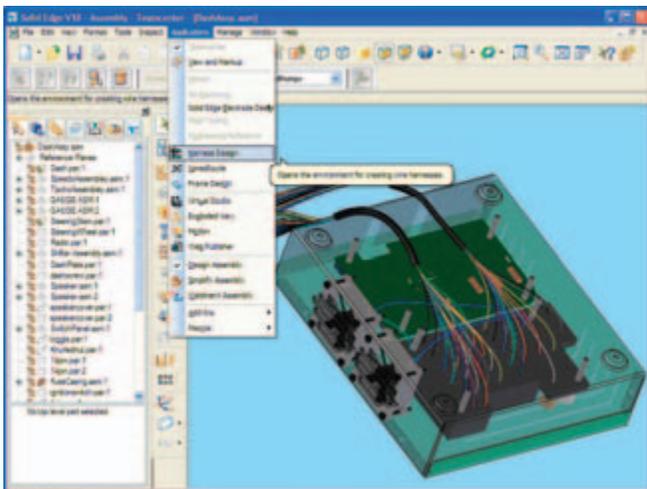


*Verifying the components from the net list*

In this example, we identified the location of the data in each of the component and connection data sets. The system allows for the connection of the eCAD component names to the physical mechanical component to be mapped. It will also identify which components do not exist so that you can design and add that to the list, or add pre-existing components to the list. This is a way of resolving mechanical components to the eCAD naming convention.

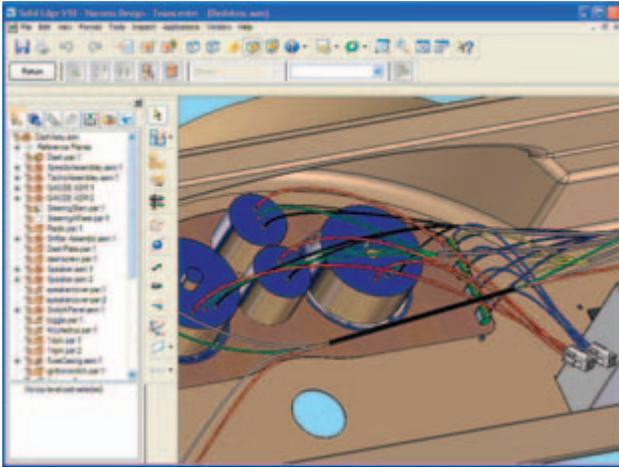
In the event that all the components have not been physically specified by the eCAD system, Wire Harness Design allows mechanical components, such as switches or connector blocks, to be placed on a grid rather than requiring exact initial placement, which makes the eCAD to MCAD transition easier. These can easily be moved later, retaining all of the wire routing data. Step 3 of the harness wizard allows satisfaction of the terminal identifications. If the system detects an error, it allows you to define the terminals from pre-existing components. At the completion of the connection and component step of the Harness Wizard, which resolves any connection issues, clicking the finish button allows all the wires and cables to be automatically placed.

Three distinct commands within the Harness Design system for wires, bundles and cables, allow a high degree of flexibility for placing, relocating and positioning the physical location of wires and bundles. Cables have a limit to the physical size of the wires that are included within them, whereas bundles can be thought of as bundles of wires physically connected using wire ties. Such bundles can be any size, and may consist of multiple cables or bundles. As in wire layout, bundles and cables can be repositioned by manipulating the blue dots (curve nodes) at start, intermediate, and end points.



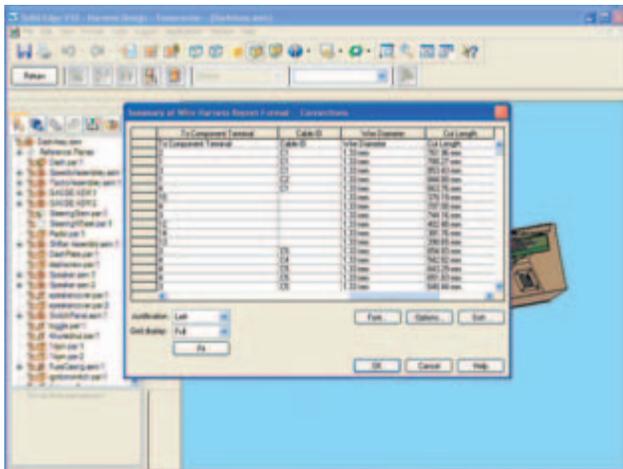
*Accessing Harness Design from the Application pull down menu*

Thus far we have been working with a path representation of the wiring, which depicts the location of the physical center point of the path. To create physical conductors, Solid Edge generates a solid model using the geometry of the path as well as the attributes of the wires and cables to compute a solid path. The image below shows the physical conductors created with solid model representations of each wire, cable, and bundle. Either visual inspection or interference analysis could detect inappropriate wiring.



The image above shows solid representations of the physical conductors created

Wire Harness Design can generate extensive data about the design, with reports that are highly customizable. Shown below is one example of an output report listing each wire, its component terminal, the cable ID, the wire diameter, and the cut length.

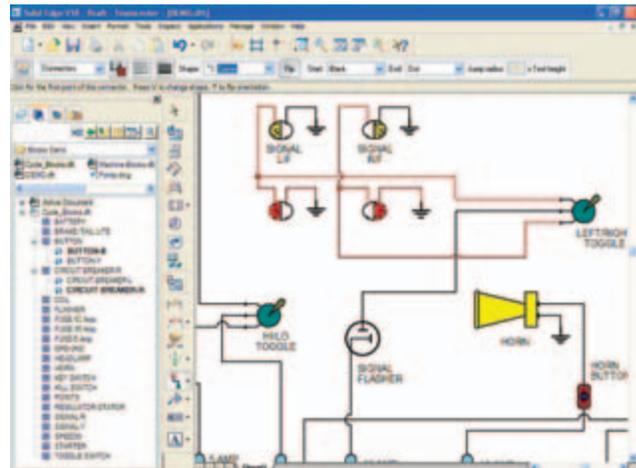


## Diagramming

Diagramming, a new intrinsic capability for Solid Edge, delivered with the Solid Edge core system, provides the capability to generate 2D diagrams, often used as layout diagrams and schematics for electrical, hydraulic, and control systems.

Diagramming places blocks (or symbols as they are sometimes referred to) on a 2D diagram and connects the symbols together via associative connectors. Moving the block moves its connection. Blocks are a group of 2D elements and can be created directly within the Solid Edge drawing system or read from available predefined AutoCAD libraries. New blocks can be easily created by grouping geometry together and defining it as a block. Block libraries can be created or extended using blocks already created or modified from those already existing. Connections offer various placement options such as jump over intersecting lines.

Multiple views of a Block can be created (states) that will accurately allow the creation of a listed bill of material. One example is a switch that can be shown either in the open or closed position, both depicting the same part number.



This image of diagramming shows some of the connection types, such as "Line", "Jump", "Corner", or "Step". The edgebar on left side of view shows where symbols (also know as blocks) can be dragged into the window.

**Electrode Design**

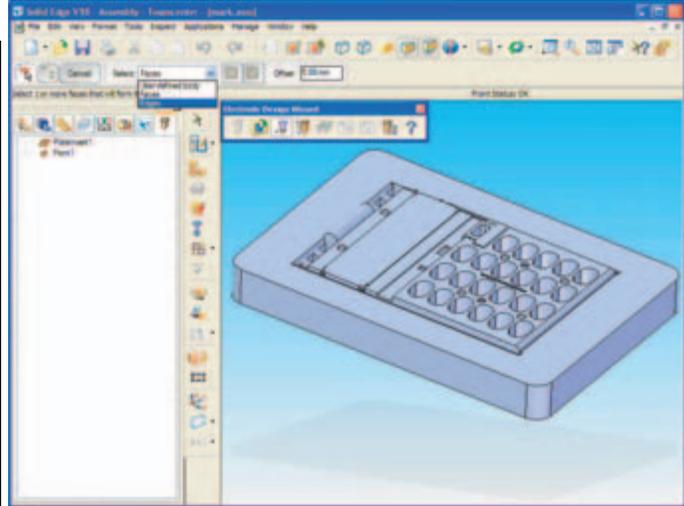
Electrode Design adds new functionality to the Solid Edge Mold Design package, which was released in Version 16. Mold Design requires Solid Edge as a prerequisite. Electrode Design is also available as a stand-alone package.



*An image showing the Electrode Design wizard steps to be followed during electrode design.*

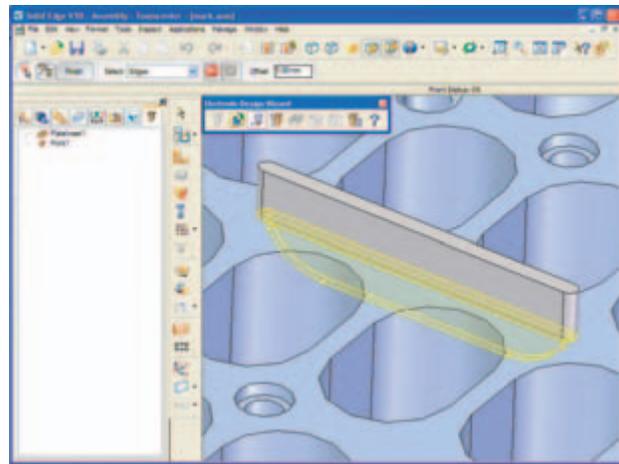
**About the Electrode Design process**

Electrical Discharge Machining (EDM), a highly accurate manufacturing process available for creating both complex or simple shapes, works by eroding material in the path of electrical discharges that form an arc between an electrode tool and the work piece. Cost and quality effective where low part counts or high accuracy is required, EDM manufacturing uses either wire or a probe called a die sinker. Wire EDM is used primarily for shapes cut shapes through a selected part or assembly. Sinker (die sinking) EDMs are generally used for complex geometries. A die sinking EDM system uses a shaped electrode tool and the part. This shaped or machined graphite or copper electrode erodes the desired shape into the part or assembly. Interesting facts about EDM: The cutting pattern is usually CNC controlled. Usually the amount of stock removed by EDM is relatively small. Traditional machining techniques remove the bulk of the stock with the finishing operations performed by EDM. This significantly reduces the amount of time and cost for each part. Many EDM machine electrodes can rotate about two-three axis allowing for cutting of internal cavities. This makes EDM a highly capable manufacturing process. The EDM manufacturer will usually fixture several parts for simultaneous machining or have several EDM operations performed simultaneously on a single part. Sometimes, the work piece is immersed in a dielectric (electrically non-conducting) fluid which is circulated to flush away debris. Dimensional accuracy of .0005 inches can readily be achieved.



*The original part, of which we wish to machine a portion using EDM.*

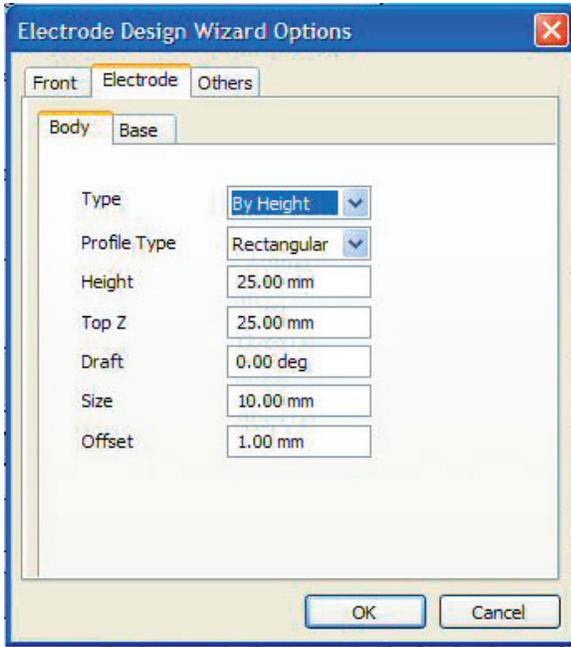
Electrode Design involves designing three portions of a CNC machine-held electrode - the front, the body and the base. The front is developed from the geometry of the part and is the die-sinking shape to create the final part geometry by eroding the part. The body holds the front, and the base attaches to the body for insertion into the EDM (Electrical Discharge Machining) machine. Solid Edge Version 18 has a number of ways to use part geometry to design the front, some highly automated and others requiring more operations, depending on the final shape desired. In the case of a pocket, the front can be produced by merely selecting the edges of a pocket. The other two techniques either use a face or a user-defined solid created from the part.



*The image above shows the creation of the front with a 5mm offset height*

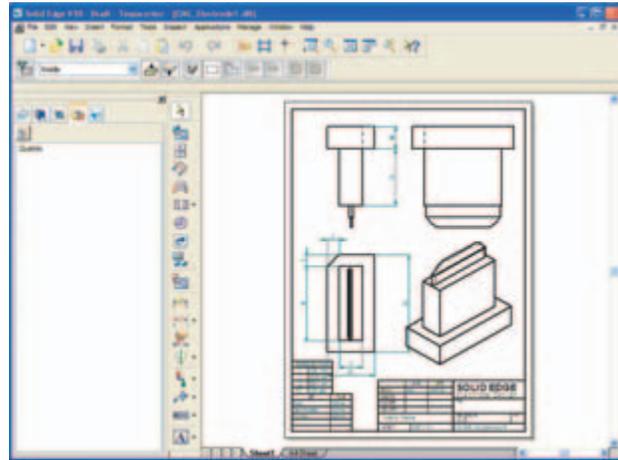
In the case where we used the edges of a pocket to define the front, Solid Edge offered significant automation by selecting the entire pocket to be burned by merely closing the edges on the top face of the pocket.

The electrode package uses a variety of pre-selected user options that allow the creation of the body and the base. Either the body or the base can be cylindrical or rectangular in shape. This depends upon the machine being used to burn the electrodes. Shown below are some of the options available during electrode design.

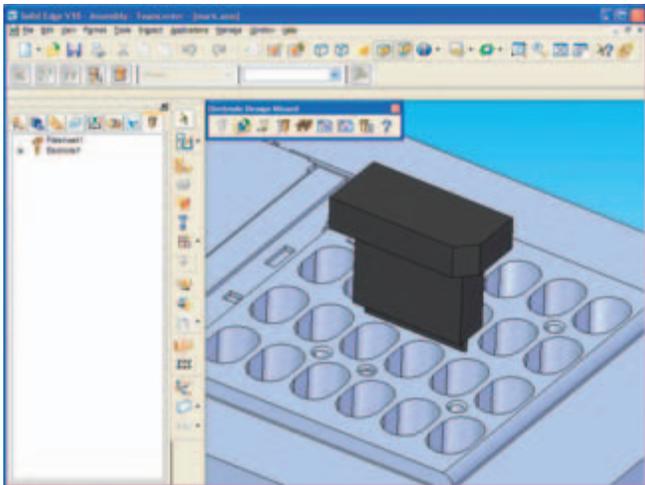


*Electrode body and base options.*

Where it is not possible to use an automated shape selection technique, the user can use standard Solid Edge capabilities to define a solid object for the electrode front. The end result of electrode design is a solid model of the electrode. Any of the normal NC techniques can be used to machine this electrode. Another output created by the Electrode Design package is a set up sheet for electrode manufacturing containing a drawing of the electrode, its positioning on the final mold, and its spark gap.

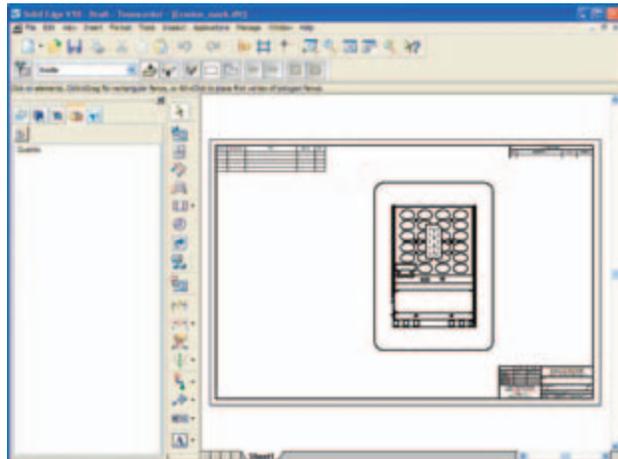


*An output drawing showing reference points for the electrode*



*The graphite electrode created*

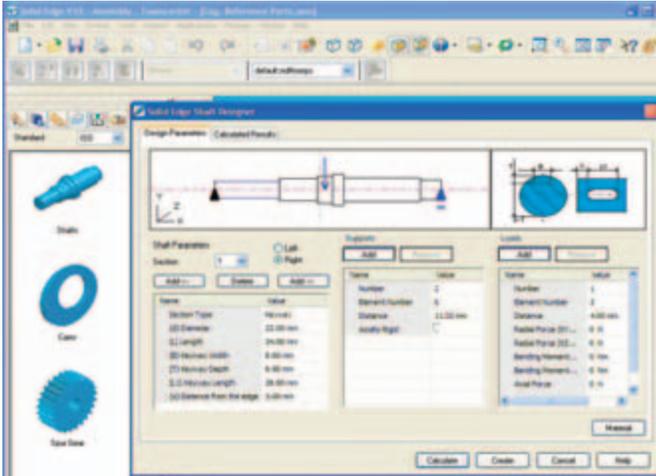
An additional output is a drawing of the actual mold design showing placement of the electrodes on the mold.



*A summary drawing showing where the electrode fits within the mold*

**Engineering Reference**

A new engineering reference function allows the automated building of certain kinds of calculation driven parts. These include shafts, cams, spur gears, bevel gears, compression springs, and extension springs. The solid models are produced by specifying the parameters of the eventual part.



*An example of the parameters being entered to create a shaft*

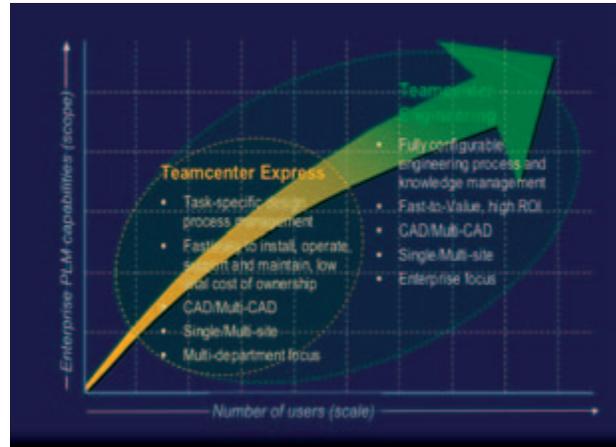
Engineering reference, upon specification of these parameters, builds the part as a result of the parametric input. Solid Edge has carefully surveyed its customer base and delivered, in this release, the most common parts. They expect to continue enhancing this in future releases.

**Teamcenter Express**

As far as positioning, Solid Edge Insight, included with Solid Edge, targets the data management needs of a design workgroup using Solid Edge as its CAD solution. Solid Edge Insight, based on Microsoft Sharepoint, uses SQL-based vaulting with check in/check out, offers comprehensive management of Solid Edge CAD data and vaulting of any file type, provides rapid searches and where-used reporting, with a remote client for consumers of design data, and is easy-to-install and easy-to-use.

On the other hand, Teamcenter Express, part of the new UGS Velocity Series of PLM products, provides an entry point into the powerful Teamcenter Engineering Portfolio for companies with multisite and multi CAD requirements. Teamcenter Express delivers an easy-to-deploy, preconfigured and easy-to-use product data management solution for mid-sized manufacturing companies. It also comes with preconfigured best practices templates for common engi-

neering tasks and processes.

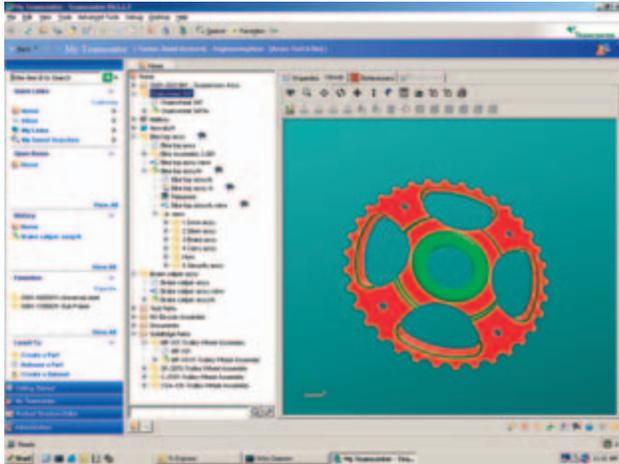


This slide, provided by UGS, depicts that Teamcenter Express fits within a gap filled only minimally by its competitors - between the high end enterprise systems and the low end, primarily PDM vaulting systems.

Solid Edge expects that Teamcenter Express will be the PLM system of choice for small and mid-sized enterprises, divisions of larger enterprises, and supply-chain partners worldwide. Why? Because it leverages the most widely used PLM platform - Teamcenter, supports multiCAD and multisite environments, offers simple/fast to install, set-up, operate, support, comes with preconfigured workflow processes and data model, uses wizards to configure, not programming, and scales to a complete PLM portfolio. MultiCAD allows the management of multiCAD product structure including native and neutral, a huge benefit for managing a global organization, even a medium-size one. Of course, it has best-in-class integrations with Solid Edge and NX. On the deployment side, Teamcenter Express features rapid deployment including installation of its server, a single installation process for all server components including Web application, file vaults, administrator client, FTS and license server, a Teamcenter database created in SQL, and CAD integrations automatically installed. A preconfigured PLM Environment with a full PLM database including user groups, user roles, standard searches, standard reports, dataset types, forms, BOM formats, lists of values and workflows is configured during installation.

TechniCom anticipates that most mid-market companies will choose Teamcenter Express as their primary PLM system rather than Insight. Furthermore, providing UGS delivers on its promises of ease of use and ease of installation, Teamcenter Express may soon dominate the market and consequently "drag along" Solid Edge and/or NX.

The image below provides only the briefest of glances at some of the power within Teamcenter Express.



## Conclusions

At first TechniCom was skeptical about introducing the UGS Velocity Series name into the mix of product names, of which Solid Edge would be a component. However, after understanding the Teamcenter Express and Femap Express, their origins, and the potential for the future, we are no longer skeptical. The full versions of both products are leaders in their categories. This is especially the case for Teamcenter; Femap being a less recognized name because it is so widely OEM'd. We are particularly impressed with Teamcenter Express, which we did not have a chance to review in detail. However, what we did see is brilliantly conceived. Providing UGS and Solid Edge can deliver on their promises for ease of use, ease of installability, and limited need for IT resource, Solid Edge users will have a world-class product at their disposal. One with true scalability and the promise to truly make PLM a reality for mid-market customers. At least one competitor classifies this market as product driven rather than process driven. Nevertheless, our experience shows that even mid-market customers have complex processes. The combination of Teamcenter and Solid Edge offers an unbeatable advantage and provides a technological breakthrough set of PLM applications.

UGS's acquisition of the Nastran source code two years ago from MSC.Software allowed the company to couple this world-class solver with Femap, their preeminent FEA pre- and post-processor to present the results. Already accepted by leading engineers from world-class companies, the Nastran solver coupled with Femap, with simplified enough for linear part analysis by the typical mechanical engineer provides more than a rough-cut first analysis. It provides the same tools used by the detailed analysis

engineer, but being tightly integrated with Solid Edge greatly enhances its ease of use, a critical decision factor for its use by design engineers.

In addition to these two significant additions from the UGS Velocity Series, Solid Edge continues to add major functions to Solid Edge itself. For Version 18, these include Wire Harness Design aimed at Electrode Design enhancing the ability to complete the electromechanical mockup and improve manufacturing; Diagramming for producing 2D diagrams widely used for hydraulic and electrical control systems; and Engineering Reference for creating parametric parts.

We are impressed by Version 18, and believe that you will be too.

## About this paper

Solid Edge sponsored this paper. The conclusions are those of TechniCom, Inc.

## About the author

Raymond Kurland is president of TechniCom, Inc. and the editor of the TechniCom eWeekly. His firm specializes in analyzing MCAD systems and has been involved in reviewing and comparing such software since 1987. Ray frequently consults with both vendors and users. He can be reached at [rayk@technicom.com](mailto:rayk@technicom.com).

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