TechniCom, Inc.

970 Clifton Avenue
Clifton, NJ 07013 USA
(973) 470 9110
http://www.technicom.com
staff@technicom.com

SolidWorks 2006 Office Premium:

Office Premium adds Routing, COSMOSMotion, and COSMOSWorks Designer, shows extraordinary large assembly performance, improves DWG, enhances drawings, and adds many enhancements

This report reviews and comments on the advanced capabilities added to SolidWorks 2006 Office Premium.

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Author: Raymond Kurland, TechniCom, Inc.

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Executive Summary

How we performed our review

This paper focuses on certain advanced capabilities of SolidWorks 2006, and takes a closer look at the analysis portion of the Office Premium product, which began life with SolidWorks 2005, and was expanded in SolidWorks 2006. We are limiting the scope of this paper to only some enhancements; SolidWorks has available exhaustive detailed descriptions of all of the SW 2006 enhancements upon request, via its web site.

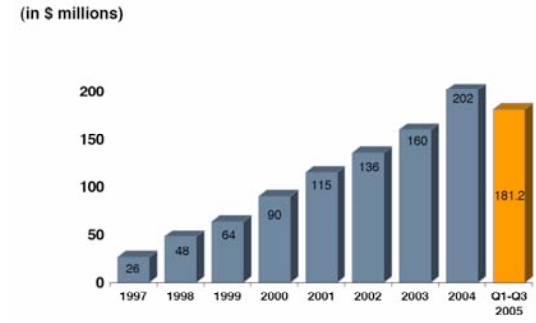
For this review, in early December 2005, I met at SolidWorks headquarters with Fielder Hiss, Manager of SolidWorks Product Management, Kishore Boyalakuntla, Technical manager for analysis products, Joy Garon, Product Manager for the PDM product line, and Aaron Kelly, Director of Product Management. I spent the entire day reviewing the specialized capabilities of SolidWorks 2006 and some data about the company performance.

The opinions and explanations are solely mine. I am always pleased to get responses from readers, who can contact me at rayk@technicom.com.

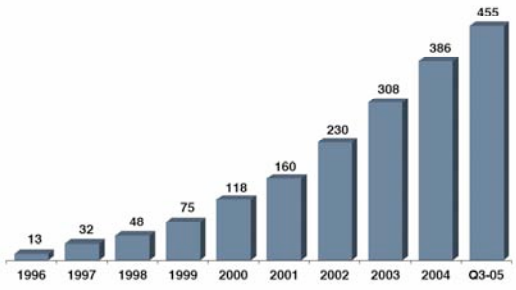
Introduction

SolidWorks 2006 previewed at SolidWorks World in January 2005 and shipped in the summer of 2005. Currently there are 3 versions – SolidWorks, SolidWorks Office Professional and SolidWorks Office Premium.

SolidWorks continues its strong showing, both in seat count and revenue, averaging more than a 15% year to year growth for the last several years, about twice the growth rate of the CAD business. More than half the sales come from customers migrating from 2D. Of new buyers of SolidWorks, more than 50% buy SolidWorks Professional or Office Premium.

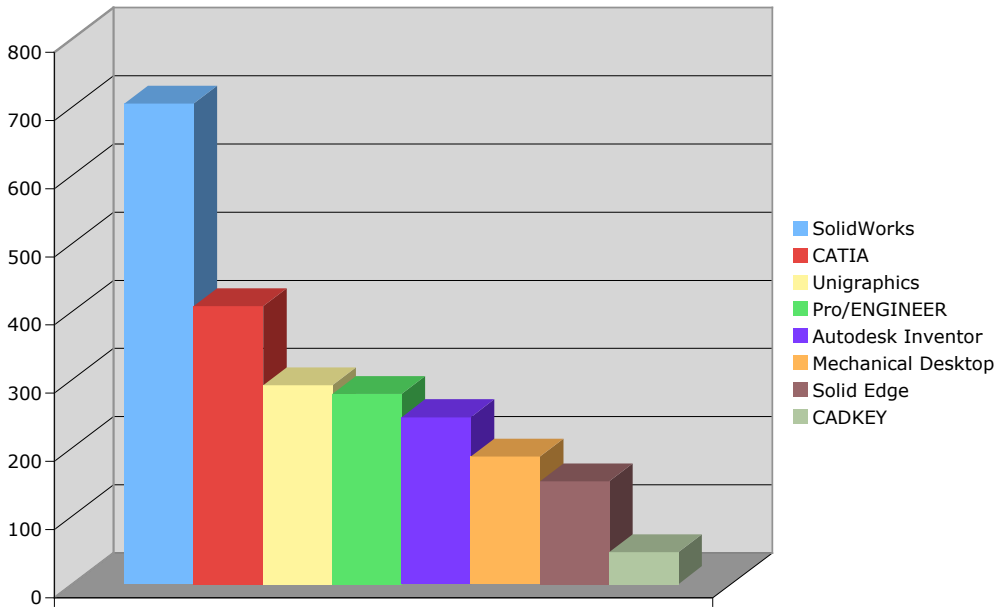


SolidWorks revenue



SolidWorks cumulative seats sold (000's)

One method of gauging which CAD system is actually used is to sample an on-line employee site, such as monster.com. As shown below, SolidWorks led in this snapshot as of last April and continues to dominate in January 2006 by almost three times its nearest competitor.



Monster.com most requested 3D design skill - January 2006
Source: TechniCom, Inc.

In the year since we last saw this chart, the gap has widened.

What we will focus on:

- Tremendous performance improvements, allowing even the largest assemblies to be easily and quickly manipulated;
- .dwg capabilities improve further the experience of users needing to access and maintain AutoCAD compatible drawings;
- Drawing enhancements - everybody has to produce drawings. The 2006 version is better than ever;
- The physical simulation embedded in SolidWorks for examining the motion of assemblies uses Office Premium's built-in COSMOSMotion, allowing more actions and easier analysis, while maintaining ease of use;
- COSMOSWorks Designer adds sophisticated analysis and excellent guidance, enhancing its results, even for casual analysis users;
- PDMWorks adds to its utility for team data management, facilitating design reuse with revision control, vaulting, searching, and lifecycle state control, all with no IT requirements and database independence.

Conclusions

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

SolidWorks 2006

The products

We hope the tables below clear up any confusion about the scope of the SolidWorks offerings. The Office Premium product, new for SolidWorks 2006, adds Routing, COSMOSWorks Designer, and COSMOSMotion to the Office Professional product for a premium of only $2500. SolidWorks still costs $3995; Office Professional costs $5495; and Office Premium costs $7995 (all are single user, USD pricing).

SolidWorks Office Professional represents such clear value that more than 50% of new users buy this product. For those users needing advanced capabilities, SolidWorks Office Premium is a huge bargain; similar analysis capabilities available in the marketplace often start at $5000.

Table 1 - The SolidWorks Product Line

	SolidWorks	SolidWorks Office Professional	SolidWorks Office Premium
SolidWorks	✓	✓	✓
DWGeditor (3 for every license of SolidWorks)	✓	✓	✓
COSMOSXpress	✓	✓	✓
MoldflowXpress	✓	✓	✓
eDrawings Professional		✓	✓
SolidWorks Utilities		✓	✓
SolidWorks Animator		✓	✓
SolidWorks Toolbox		✓	✓
FeatureWorks		✓	✓
PhotoWorks		✓	✓
SolidWorks Task Scheduler		✓	✓
3D Instant Website		✓	✓
SolidWorks Design Checker		✓	✓
PDMWorks		✓	✓
SolidWorks Routing			✓
COSMOSWorks Designer			✓
COSMOSMotion			✓

Table 2 - A brief description of the SolidWorks software tools

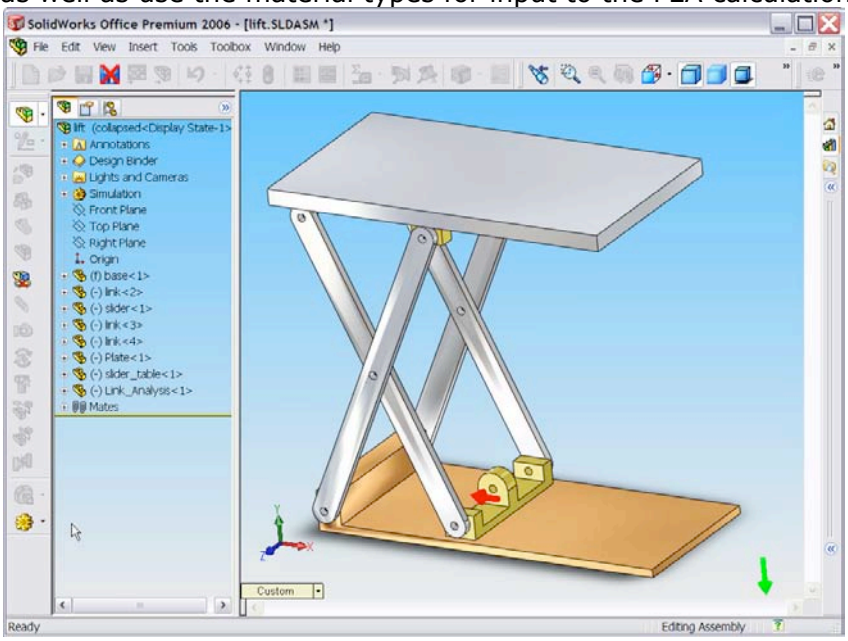
- SolidWorks -- 3D solid modeler.
- DWGeditor -- Enables you to edit and create native DWG files in a familiar user interface.
- COSMOSXpress -- a point-and-click stress analysis Wizard built into SolidWorks 3D modeling software.
- MoldflowXpress -- a plastic fill analysis Wizard built into SolidWorks 3D modeling software. MoldflowXpress guides you step-by-step through the fill analysis process to help minimize material and optimize cycle time.
- eDrawings Professional -- Generate accurate representations of 2D and 3D models that anyone can view, mark up, and measure without having to purchase their own markup tools.

- SolidWorks Utilities -- Find differences between two versions of the same part quickly and easily.
- SolidWorks Animator -- Create compelling AVI files from SolidWorks parts and assemblies.
- SolidWorks Toolbox-- Automate assembly tasks with a library of standard parts.
- FeatureWorks -- Feature recognition software simplifies the reuse of 3D CAD data created in varied file formats.
- PhotoWorks -- Create photorealistic images.
- SolidWorks Task Scheduler --Saves time by enabling you to schedule resource intensive tasks, such as batch printing, running of analyses, and updating of project files during periods when you will be away from your workstation.
- 3D Instant Website -- Create and publish live web pages with 3D interactive content.
- SolidWorks Design Checker -- A timesaving tool for ensuring compliance with your organization's design standards.
- PDMWorks -- Minimize errors and duplicated efforts by capturing file revision histories automatically. Access desired files, determine who has worked on them, and see exactly when changes were made.
- SolidWorks Routing --Enables you to quickly and easily design pipe, tube, and electrical routes in your product designs.
- COSMOSWorks Designer -- contains the most frequently used design validation tools, offering stress, strain, and displacement analysis capabilities for both parts and assemblies.
- COSMOSMotion – allows designers to simulate mechanical operations of moving assemblies and the physical forces they generate.

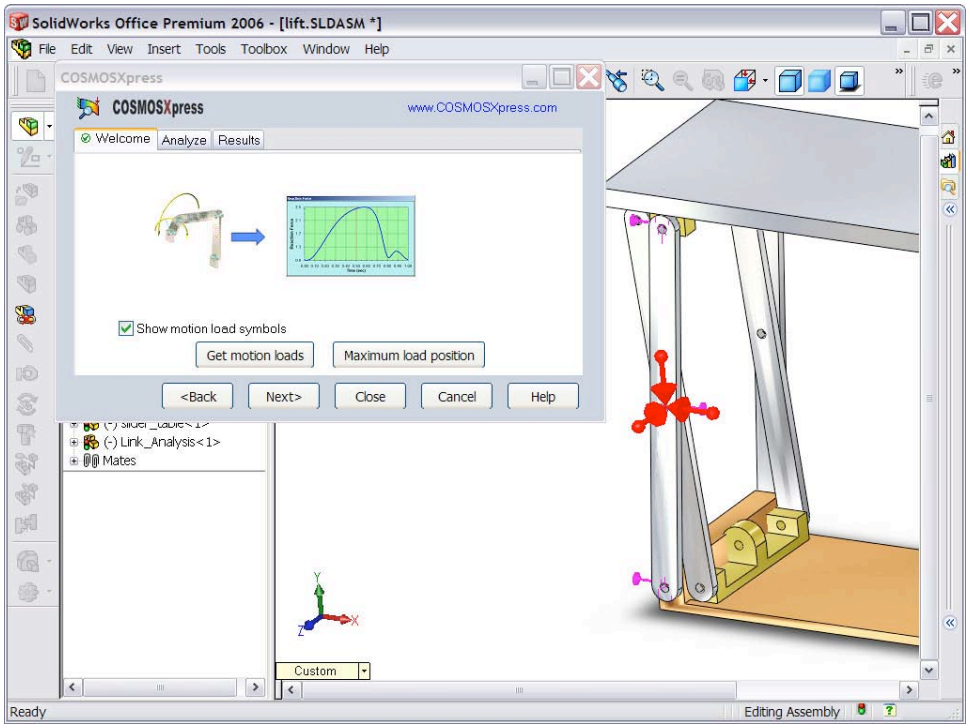
COSMOSMotion now part of Office Premium for built-in SolidWorks physical simulation

COSMOSMotion built-in, now allows advanced physical simulation of SolidWorks models, adding at a bargain price, advanced motion analysis function. The physical motion is automatically derived within SolidWorks by users building an assembly with the normal mating conditions and linkages. New is the ability of COSMOSXpress to easily perform stress analyses on a part in an assembly. The full capabilities of COSMOSMotion are available in SolidWorks Office Premium.

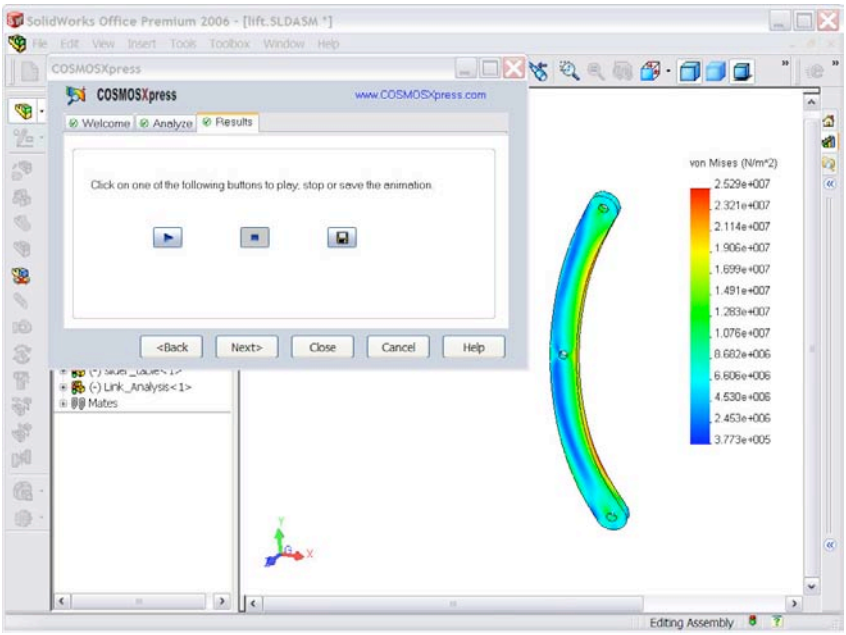
In the example of the lift assembly shown below, once the user builds his assembly, all of the data needed for analysis of the model, in terms of motion and linkages, has already been incorporated into the design. The three images below show the steps to take an assembly with Physical Simulation and transfer the loads and boundary conditions to COSMOSXpress to automatically set up the analysis problem. No additional input is necessary for motion analysis providing the user has entered material types for each of the parts. The system then can calculate weight and mass properties, as well as use the material types for input to the FEA calculations.



Physical Simulation allows designers to insert motors and gravity in order to simulation how assemblies operate in real life.



The forces from physical simulation can then be transferred to COSMOSXpress to set up the boundary conditions for a structural analysis of the link arm of the lift assembly. This automation reduces the need for users to worry about how to correctly set up the structural analysis.



With the problem setup automatically using the forces from how the assembly moves, designers using COSMOSXpress can now see if the design of the link arm is sufficient.

This simple example shows just some of the benefits beginning to emerge from having a fully integrated analysis company -- a unique synergy in the mainstream market. These include closely directing the development direction of COSMOS to

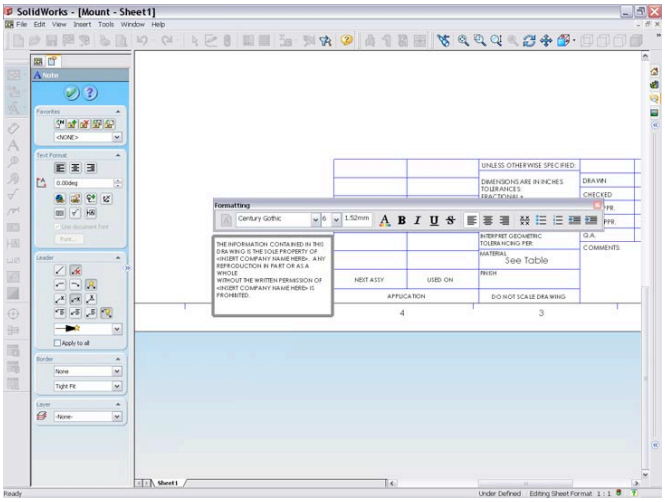
provide better integration with SolidWorks. This is clearly evident in its ease of implementation, ease of training, and smooth integration with advanced COSMOS functionality.

Drawing enhancements - continuing to make the drawing process easier

SolidWorks continues to enhance its drawing capabilities. We reviewed some of the more interesting enhancements for detailing SolidWorks 3D models. These included: Spell-check for an entire drawing, text boxes on a drawing, limiting the depth visibility of section views, model rotation within drawing views, and expansion of the DWG capability to read and write AutoCAD files.

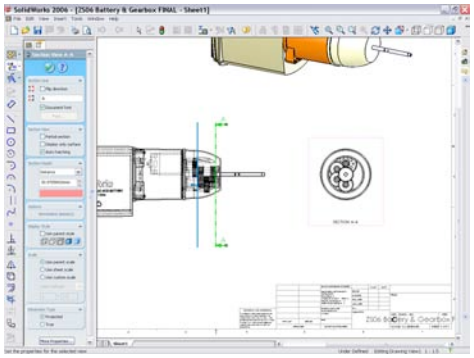
Spell-check interrogates an entire drawing to see if there are any spelling errors, an often requested feature, and the only 3D system that has this capability.

"Text in a box" is impressive; re-sizing the text box automatically reconfigures the text internally. An enhanced table capability allows adding add rows and columns, and can also incorporate some equation logic. Users can ask for the sum of a column, which automatically calculates the total and places it on the drawing.



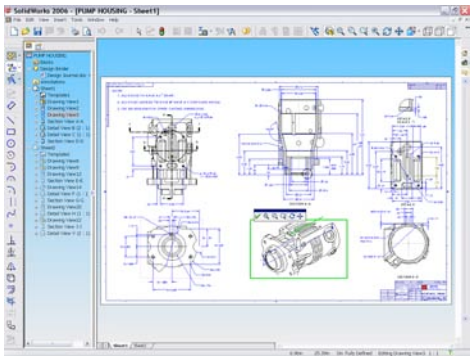
Text_In_Box

Section view depth allows the user to limit the depth that you visualize from a particular section cut, thus making this function more useful. Depth limitation operates as if there were a plane at the extent of the selected depth, hiding everything behind it.



section_plane.jpg

A 3D drawing view enhancement allows you to rotate out of the plane in a specific view. It allows the user of a drawing (on the computer, not paper) the ability to rotate any view, to better visualize what that view represents. This unique capability in SolidWorks is one that I have never seen before. It operates extremely fast and can snap back, on command, to the original position. I loved this and I am sure users will too.



Dynamic_Drawing_View

DWG capability allows reading and modifying AutoCAD DWG and DXF files

The DWG capability, which allows reading and writing of AutoCAD files, continues to be enhanced. The DWG series now consists of the DWGeditor, DWGgateway and the DWGviewer. The DWGgateway and DWGviewer are free. More information on the DWG Series can be gotten from http://solidworks.com/pages/infofor/DWGseries2.html . Three copies of DWGeditor are included with each version of SolidWorks. The DWGeditor allows users to directly open AutoCAD DWG files. It uses the OpenDWG libraries and was first released in SolidWorks 2005. DWGeditor for SolidWorks 2006 has more enhancements, is easier to use, offers the 3 to 1 licensing ratio, and provides proxy entity support for AutoCAD mechanical and electrical extensions.

Different than AutoCAD, SolidWorks 2006 supports AutoCAD, DWG and DXF data, all the way back AutoCAD 2.5 and allows users to save the data in any of the supported formats; even in AutoCAD 2006 format. DWGgateway, a plug-in for AutoCAD, allows AutoCAD users to open any version of AutoCAD files and save it in any of the supported versions. Users downloaded more than 250,000 copies of this free software download by the end of 2005. The current version of DWGgateway also allows saving in acrobat (.pdf) format.

DWGviewer is actually eDrawings. For some time, eDrawings has had the capability to open and view DWG and DXF files. SolidWorks believes that by providing this capability, the company adds value for their customers by eliminating the need to keep inactive 2D seats.

PDMWorks - PDM without IT resources

PDMWorks, included as part of SolidWorks Office Professional and SolidWorks office Premium, adds to its utility for team data management, facilitating design reuse with

revision control, vaulting, searching, and lifecycle state control (simplistic workflow), all with no IT requirements and database independence.

PDMWorks has impressive capabilities for team data management -- enabling the sharing of information during the development phase. Without the need for extensive IT support, this capability is not only a no brainer for most SolidWorks installations, but also adds web based collaboration, a facility for editing product data making starting new projects easier, and security.

For users desiring a move to enterprise data management, offering both benefits and added complexity, a wizard allows PDMWorks data to be readily moved to SmartTeam, a Dassault Systemes data management offering.

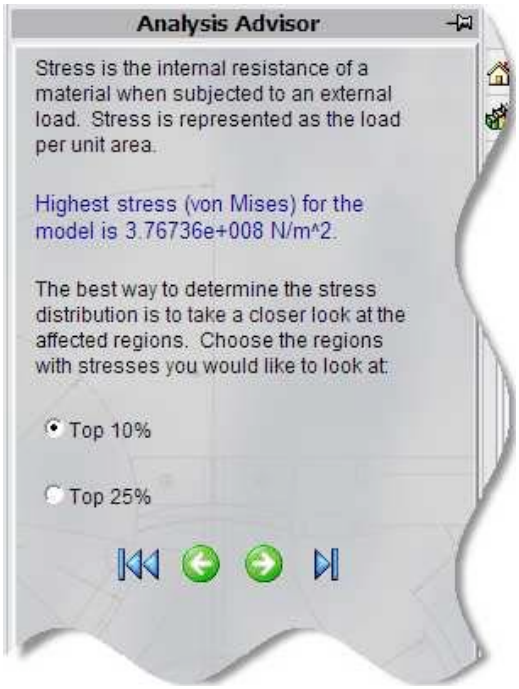
COSMOS adds exceptional capabilities that make analysis easy to use

The COSMOS group at SolidWorks has made many COSMOS enhancements since they've become part of SolidWorks -- for two primary reasons. First, the COSMOS group concentrates exclusively on software development and not sales, thus they are more efficient. Second, by limiting their integration strictly to the SolidWorks environment, they can more tightly bind the interactions between the two software packages. As a fully integrated company, COSMOS has added exceptional capabilities that make analysis easy to use, easy to train, and much easier for users to move into design validation. Evidently this strategy is working. The number of seats of COSMOS doubled between 2003 and 2004. SolidWorks expects that a comparable increase occurred in 2005.

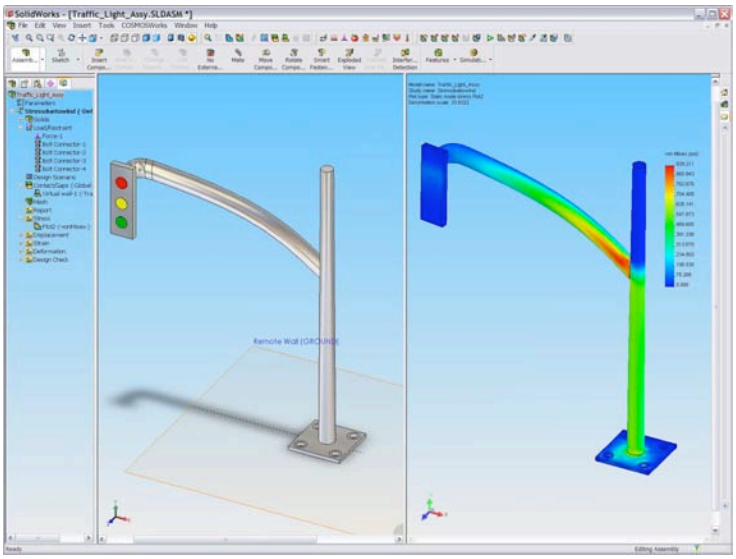
COSMOSWorks, a powerful, easy-to-use design validation and optimization software, fully embedded within SolidWorks offers an ideal solution for engineers who need analysis but are not specialists in finite element analysis. *COSMOSMotion* is a complete motion simulation and kinematics package, with some capabilities incorporated into the physical simulation of SolidWorks software. The full capabilities of COSMOSMotion are available in SolidWorks Office Premium. Designed for engineers who are not necessarily specialists in computational fluid dynamics (CFD), *COSMOSFloWorks* redefines fluid flow analysis with robust capabilities normally found in high-end CFD programs.

During our visit we reviewed some of the new functions including: the new analysis advisor, improvements in both physical simulation and drop test, and ground bolt. Other added function includes improvements to spot welds and sheet metal analyses.

The analysis advisor is particularly impressive because it seems to have the capability to take a novice user entirely through a decision of what items are important in setting up and analyzing results. It interacts well by presenting and suggesting the key areas that he needs to be aware of. Analysis advisor is available with the COSMOS products, not COSMOSXpress.



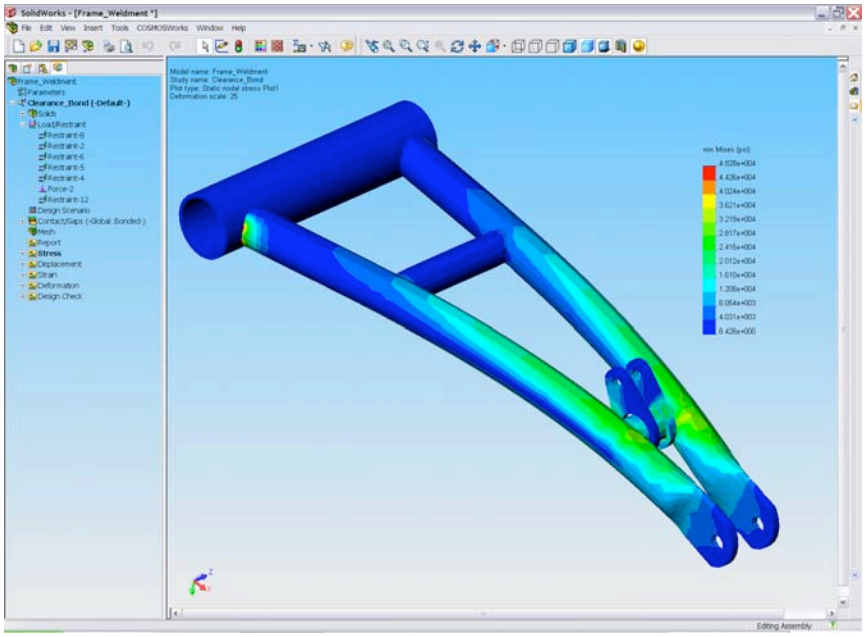
Ground bolt is interesting; it takes into account the fact that a large external body to which an object is attached may have an independent failure capability. One example is a bracket mounted to a sheet rock wall, with excessive force on the bracket. Prior to this version and most other analyses, the failure of the wall would not have been taken into account. In this version, the wall parameters would be taken into account so that the failures in the wall or the ground could be predicted allowing users to get more accurate results in less steps.



Bolt behavior of the traffic light post is modeled using the grounded bolt connector in COSMOSWorks 2006

Another interesting enhancement, the drop test capability, now allows contacts between parts inside an assembly. All these capabilities are available within COSMOSWorks. Complex shock analysis predicts stresses from the drop analysis.

Most assemblies have a small clearance between the parts to account for manufacturing tolerance. Now users can bond these parts even if the components do not touch each other.

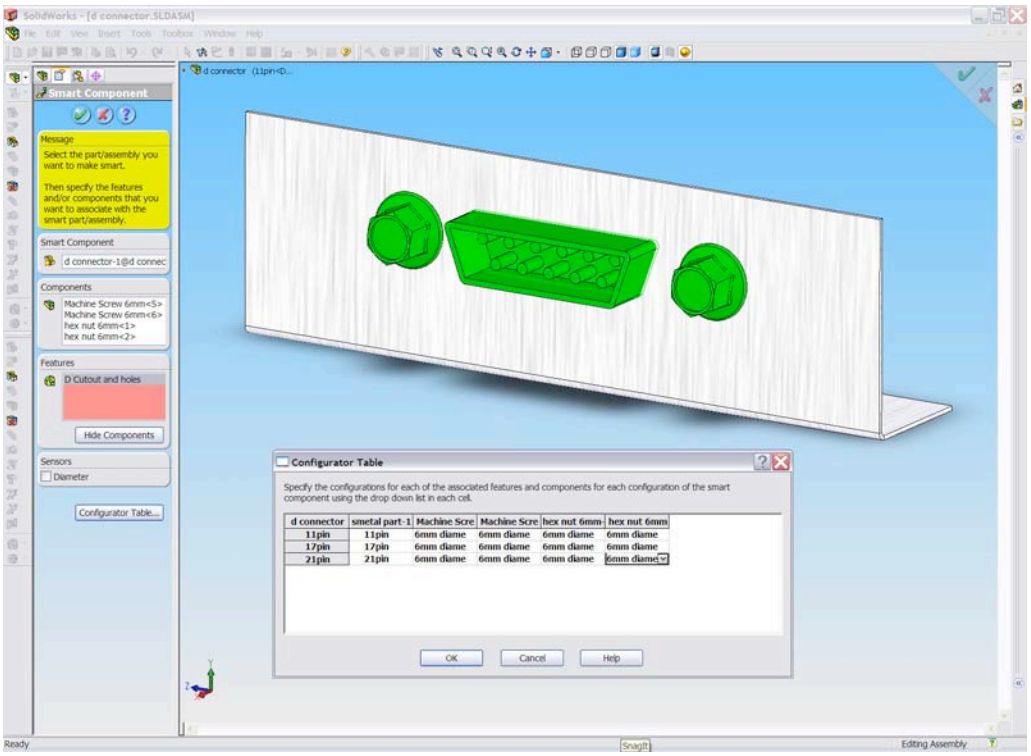


Note the gap where the connectors join the lower support

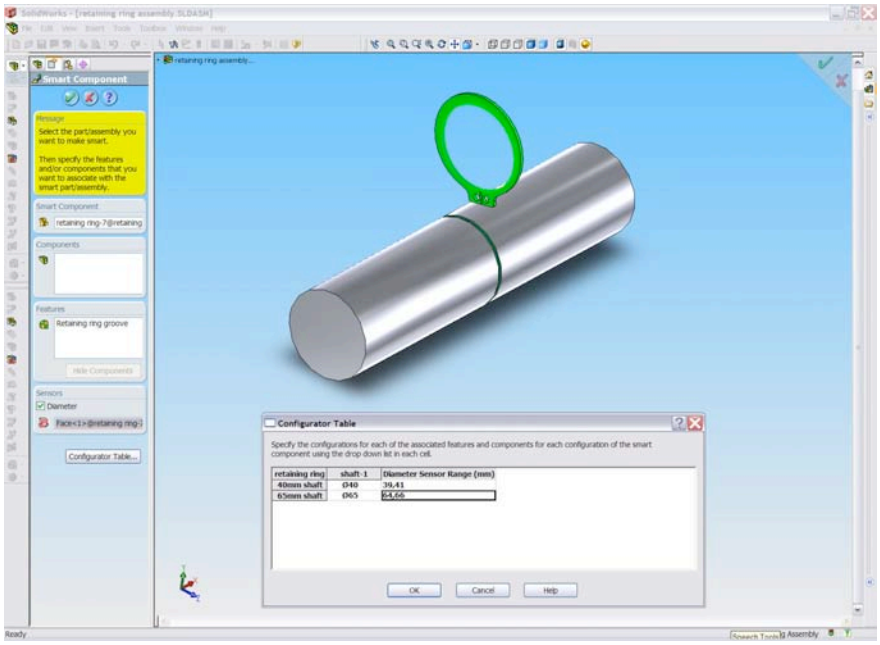
Smart Components define how assembly parts behave

Smart Components have the ability to be brought into an assembly. When you drag around a smart component, it senses the mating condition and will snap into place into an assembly. When it does snap into place, it senses a parameter that it is mating to and selects from a pre-defined configuration of sizes for that smart component. It uses that configuration in the assembly. When placing a smart component, a graphical indicator appears on the component indicating that there's more information to be placed. Clicking on this indicator, a property manager came up signifying the information it was requesting. In our case, it wanted a face selected for the pillow block to build a boss onto. Selecting this face automatically generated, not only a boss connecting to the face of the part, but brought in such information as bolts, washers and mounting features. We brought in not only additional components in Smart Component, but could place additional features onto the mounting part. In our case, it produced tap holes to which the bolts connected. Smart Components can be generated from already created designs by leveraging existing configurations and publishing them into the smart component library.

Smart Component authoring allows users to define how parts or assemblies will behave when placed into an assembly. For example, users can teach an assembly what parts to include and what features to create when inserted into another assembly. The Smart Component always operates as one item.



Smart Component authoring allows the creation of smart part and assembly libraries which aid in enforcing corporate standards.



Smart Components speed design by automatically sizing a part based on the diameter of a mating part.

Large assembly performance vastly improved

Significant work has been put into substantially improving the performance of large assemblies. SolidWorks claims that it can be virtually instantaneous once it is loaded into memory to do the drafting, rotation, any visualization or working with the massive assembly. In our example, when we opened up an assembly with some 1800 components, it took about 15 seconds to open. We were working on 1.8 gigahertz laptop, not a high performance desktop. We were able to draft the full assembly very quickly. We built four views including bill of materials and dimensions basically as fast as it can be placed. We were able to add dimensions very quickly. Surprisingly enough, we were able to perform a full hidden line rotation as quickly as we could rotate around the screen; very impressive performance.

We were also surprised to see a full interference analysis among all of the 1800 components in the assembly completed in seconds, not minutes or many minutes as we are used to, without a need to limit the range of interference analysis.

To enable such a performance increase, SolidWorks 2006 re-architected its lightweight mode and thus has greatly improved its large assembly performance: it decreased the time to perform common operations and reduced the required system resources when working with large assemblies. Significant improvements in SolidWorks lightweight technology allows, in most cases, working with assemblies and drawings of those assemblies, exclusively in lightweight mode. Sample cases show improvements of up to 6 times faster opening large assemblies.

In SolidWorks 2006, assembly operations are now available that previously required lightweight components to be resolved, including selecting or mating to their edges or vertices, displaying in hidden line or wireframe mode and performing mass properties or interference detection. The components have to be resolved only when you perform an operation that requires feature information.

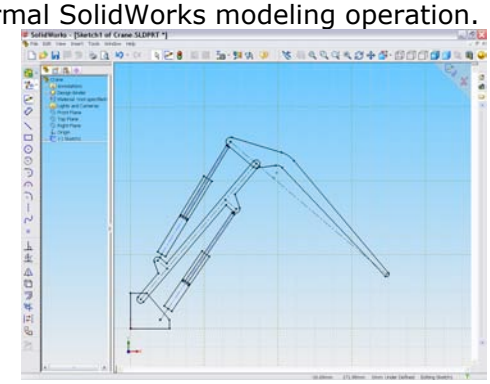
Performance of drawings of large assemblies is improved significantly with lightweight drawings. Loading a lightweight drawing is faster and uses significantly less memory than loading the same drawing with fully resolved parts. Only parts that are affected by changes that you make in the current editing session become fully resolved.

SolidWorks 2006 employs background processing of hidden line removal calculations. Users can begin detailing operations such as dimensioning and annotations while HLR calculations are done in the background.

Sketch blocks allow large scale machine design using 2D layouts

The last thing we looked at was sketch blocks, primarily useful for machine design. This is the ability to perform 2D motion analysis using sketches. We were able to draw a sketch and then block the sketch so it acted as if it were a single component. We then dragged it into position in a 2D sketch assembly and added relationships among the 2D sketches. In particular, we fixed one end of a piston to a point and made the other end tangent to a line so it could act as a slider. We were able to examine the motion analysis of this 2D assembly sketch. *Fascinatingly, at any point in time when we completed this, we were able to use the sketch input to create the 3D components that could then become part of the assembly.* SolidWorks 2006 allows taking each of the sketches in the sketch assembly, grouping them, and converting them to parts. Then, each of the parts could be edited and a 3D

component generated from the sketch. When done, it automatically becomes part of the assembly. It is a normal SolidWorks modeling operation.



Blocks in the sketcher are used to layout mechanisms in 2D and convert them into an assembly with parts based on each block.

Conclusions

SolidWorks management feels that the significant advantages to SolidWorks 2006 consist of COSMOSWorks total integration into SolidWorks, the performance in large assemblies, smart components, and improved physical simulation. We agree and hope that some of the items discussed above convince the readers of this document to take an in-depth look at the latest software for your product development organization.

We are particularly impressed by the continuing focus of SolidWorks (the company) on the design aspects of product development. Too many other companies seem to feel that their future rests with enterprise-wide data management, process automation, and the management of large complex products. To their credit, SolidWorks leaves much of the work in these areas to their partners, and thus free themselves to focus on the underlying design capabilities of the solid modeling software.

Users will find that the already enormous power of SolidWorks 2006 is greatly leveraged by the more than 500 SolidWorks partners and more than 300 SolidWorks 2006 resellers, buttressed further by other SolidWorks initiatives such as 3D PartStream.net and the SolidWorks Manufacturing Network.

About the author

Raymond Kurland is President of TechniCom, Inc., a market research and analysis organization specializing in understanding, consulting, and reporting on mechanical product development software. TechniCom offers a continuing research program for software vendors and frequently consults with users considering embarking on re-evaluating their product development systems. Ray interacts with most of the leaders in the PLM industry and has been instrumental in "bringing together" companies in several recent acquisitions.

Ray is the primary contributor for www.cad_portal.com and writes commentary for that site. He is currently exploring the subjects of lean design, innovation, and how companies can profit from strategic marketing initiatives.

Ray is a cum laude graduate in Engineering with a Bachelors degree from Rutgers University, a Masters degree in Engineering from New York University and holds an MBA from Rutgers University as well.

His work experience includes stints as a developer at Bell Telephone Laboratories for six years, sales and product manager at IBM for 18 years, and 2 years as head of North American Marketing for Dassault Systemes. He has run TechniCom since 1989. He can be reached at rayk@technicom.com.

Helpful URLs

DWG Series information:
http://www.solidworks.com/pages/infofor/DWGseries2.html

Sales office locations:
http://www.solidworks.com/pages/company/SolidWorksOfficeWorldwide.html