Documenting designs in 3D

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▶ With new standards for 3D product definition, CAD models legitimately join 2D drawings as a fully sanctioned means of conveying product and manufacturing information. Siemens PLM Software has been instrumental in defining the standards for 3D product definition, and delivers software tools that make it possible to document 3D designs in compliance with the new standard. The new 3D annotation capability enables significant process improvements.

PLM Software

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As the global manufacturing market grows continually more competitive, the use of 3D solid models has proven to be the competitive driver for many companies. Far superior to 2D drawings, 3D models can shorten design cycles through better communication, fewer errors, streamlined design and manufacturing processes and faster changes – all of which result in higher quality products at a lower cost. Yet many companies taking advantage of the 3D explosion still create 2D drawings, either as deliverables or for their own internal use.

It has long been possible to annotate solid models with information that is typically contained in drawings. But now, with the release of an American Society of Mechanical Engineers standard for 3D product definition (ASME Y14.41), 3D models can legitimately join 2D drawings as a fully sanctioned means of conveying product and manufacturing information. Siemens has been instrumental in defining the standard for 3D product definition and, in turn, delivering software tools that make it possible to document 3D designs in compliance with the new standard. This white paper explains why ASME Y14.41 is important, how Siemens supports the standard and the dramatic process improvements made possible by the use of 3D product definitions.

In August, 2003, solid models became more valuable than ever. That was when the American Society of Mechanical Engineers released ASME Y14.41, the new standard for 3D "digital product definition data practices." This standard is important because it legitimizes the use of 3D models as an ASME-sanctioned method of conveying product and manufacturing information (PMI), eliminating the need for multiple digital product representations (2D drawings in addition to 3D models) and opening the door for significant process improvements.
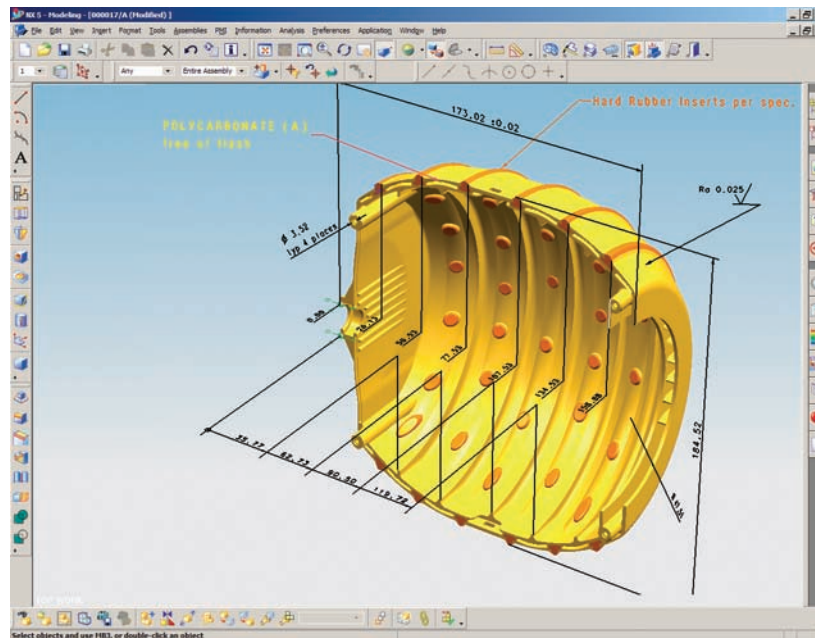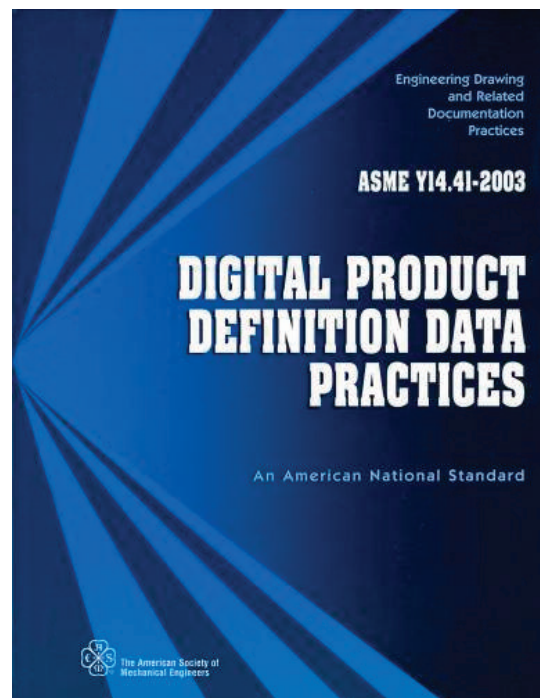
Work began on ASME Y14.41 in 1997. At that time many designers were already annotating solid models with information needed for manufacturing, such as dimensions, tolerances, assembly notes and so on, but each did so in a proprietary way and the industry lacked a common method. Without a common and recognized standard, most companies continued to convey and maintain manufacturing information through 2D drawings.

Drawings cost time and money, and can represent a substantial overhead in new design projects, especially for the intricate models required for consumer products or the large and complex assemblies common in the machinery industry. Drawings rarely escape further modification as the product evolves, introducing a more pressing problem of how to keep drawings and solid models in sync after design changes are made. Recognizing this, ASME formed a committee to extend its standards for 2D drawings (ASME Y14.5M) into the 3D world. The committee wrote, "3D modeling is the future of design, and ASME Y14.41 sets the rules."

Siemens has been a member of the Y14.41 committee since its inception and has played a key role in helping define the new standard. Our commitment is unmatched in the software industry.

Engineering Drawing
and Related
Documentation
Practices

ASME Y14.41-2003

DIGITAL PRODUCT
DEFINITION DATA
PRACTICES

An American National Standard

The American Society of
Mechanical Engineers

ASME Y14.41 calls for certain capabilities within the design system. Because Siemens worked closely with ASME on the creation of the new standard, we have been able to ensure that our NX™ software solution for digital product development delivers the functionality needed to produce 3D annotated designs that are in full compliance with the standard. As recognition of ASME Y14.41 grows in the marketplace, it is common for people to ask "Can your software produce models that are in compliance with the new standard?" We are proud to be able to reply, "Yes. Absolutely."

NX includes well established capabilities for 3D annotation, and Siemens' customers worldwide are actively utilizing and endorsing 3D annotation on their solid model designs. Supporting all the major concepts and requirements defined in ASME Y14.41, this comprehensive list of capabilities in NX 5 provides the most complete collection of tools offered within a CAD product to date, and further enhancements are being developed.

NX 5 collects these capabilities under a menu selection that contains all the tools necessary for making 3D models the master repository for all product and manufacturing data. The PMI toolbar provides a single, unified interface for creating, editing and querying PMI on the solid design. In addition to facilitating the creation of 3D product definitions, this tool will check models for compliance with the ASME standard, offering the options of stringent and relaxed compliance levels.

Designers attach 3D annotation directly to the model by associating it with the appropriate portions of the geometry to indicate design intent. The plane in which the annotation is created is under the user's control and is used to facilitate placement of the annotation by defining its reading direction. Model Views (equating to Saved Views in ASME Y14.41) can be used to manage the annotation on a model by organizing it into sets of information relevant to a specific orientation of the model or a particular application for the model. The NX Part Navigator organizes PMI annotation into a convenient location for viewing and interrogating its associativity to the model geometry.

Of course, Siemens recognizes the ongoing need to create and maintain 2D drawings. The annotation placed on the 3D model can be leveraged to create accurate, production-ready and fully associative detailed drawings with not much more than a single click of the mouse.
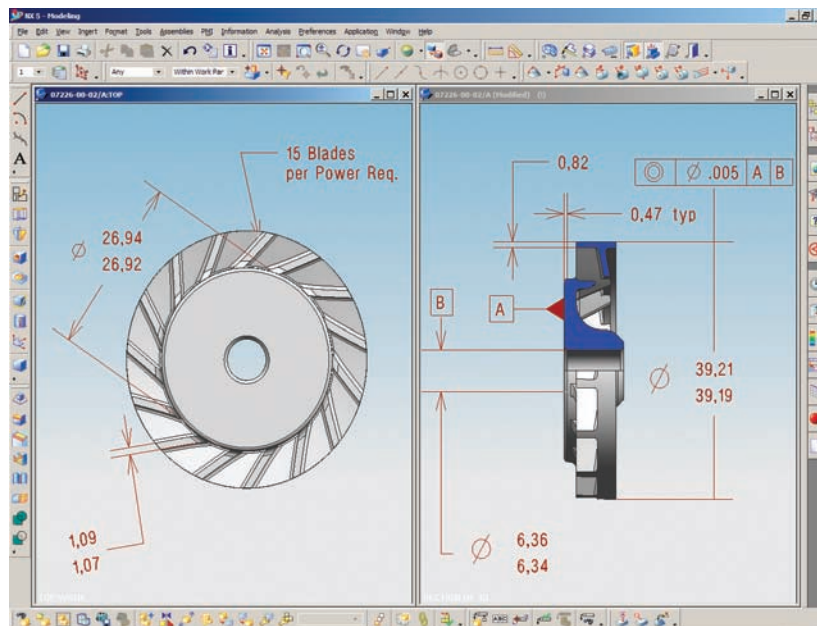
When solid models become the repository for PMI, a company has a true "master model" approach. Instead of having solid models for defining product geometry and drawings for conveying production information, there is a single digital representation (the annotated 3D solid model) that documents everything about the product. This 3D information is always accurate, always up to date and can even become "invalid" under certain conditions, alerting the user to take action and preventing costly downstream problems. This also eliminates the difficulty of keeping multiple product representations in sync and opens the door to a more efficient way of creating and documenting products.

As engineers and designers add more PMI to the solid model during creation, these master models become increasingly "smarter," going far beyond a geometrical representation to explicitly embed design intent and eliminate the risks introduced from a reliance on human inference as the models are leveraged in all downstream processes. In fact, this is the primary vision of PMI. Create it once, use anywhere.

For example, 3D annotation embedded in a model can be imported into analysis and CAM applications, sent to suppliers and used on the shop floor – just as drawings would have been used in the past. But these models, because they are 3D, are much easier to visualize and understand. There is no need to mentally reconstruct the model from 2D representations and it is easier to query the original design intent, both of which mean improved communication from the start and a higher probably of the right product, right the first time.

Inexpensive and intuitive viewing applications, such as Siemens' Teamcenter® Visualization products or XpresReview, make master models accessible to the broad base of people throughout the extended enterprise and supply chain who don't use CAD. And because the PMI is integrated and associated with the 3D model, the PMI content can be directly leveraged in digital applications such as tolerance analysis and machine toolpath generation, without the need to re-enter the data. In situations where drawings are still required, such as in work for government organizations, 2D views can be spun off the master model in minutes.
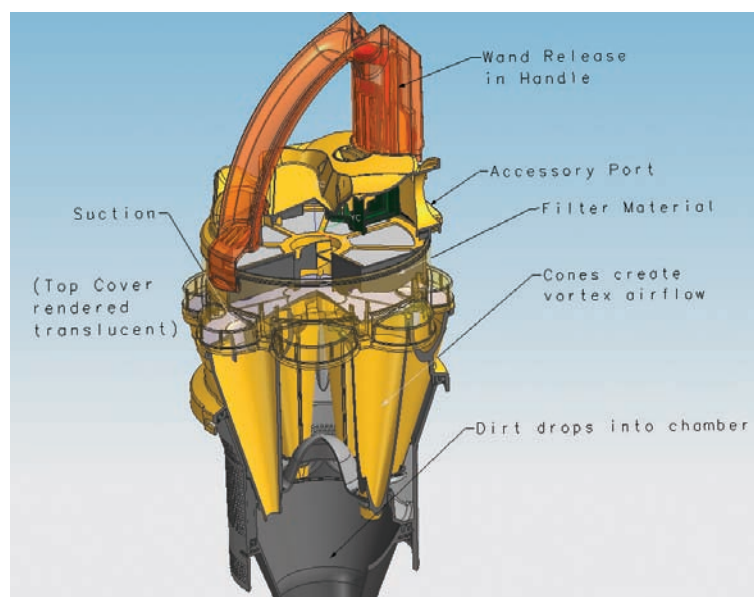
The work we've done so far at Siemens PLM Software is just the start. We'll continue to enhance our software to support ASME Y14.41 as it evolves, and as your processes evolve in turn. Siemens believes that 3D product definition represents the future, and that 3D master models will eventually become the predominant way of documenting and conveying product data. We'll do what we need to do to make sure your company benefits from the evolution to 3D product definition.

Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with 6.7 million licensed seats and more than 63,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit *www.siemens.com/plm*.