Windows Modeler Handles 12-Station Stamping Die

The entire die assembly contained 2,338 parts.

Summit Tool Design

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President and Designer

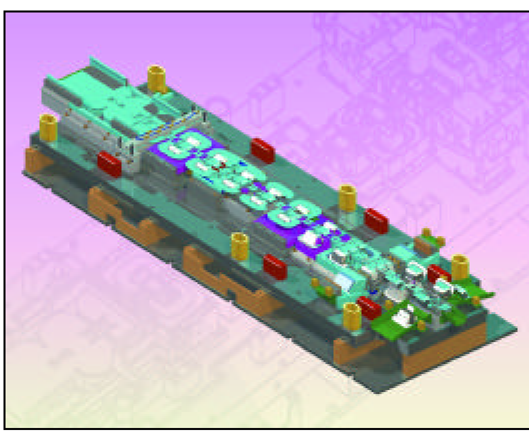
Summit Tool Design (Rockford, IL) recently used a Windows-based solid modeler to design a 12-station stamping die for sheet metal automobile parts. Working in 3D saved time over the more traditional 2D approach, particularly during the production of detailed drawings. More importantly, however, the use of 3D ensured accuracy in the finished tool. Because the solid model was much easier to visualize than 2D drawings, the designer was able to spot interferences that he might have missed. "My time savings were substantial but they are insignificant compared to what I saved the client by delivering a design that was free of interferences," says Scott Christensen, president of Summit Tool Design and designer of the 12-station die.

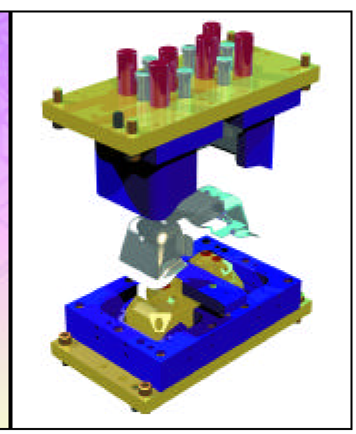
Greater Complexity in Dies

Producing sheet metal now requires very complicated tools. It is not uncommon to have one die, known as a progressive die, perform ten or more operations, including cutting, bending, and piercing on multiple parts at a time. In addition, companies are striving to increase productivity by eliminating costly secondary operations and incorporating them into the primary progressive die. These developments pose challenges to stamping die designers who must squeeze many components into a limited working envelope while dealing with the complex shapes of the finished part.

For these reasons, some stamping die designers are migrating from 2D CAD to solid modeling. Christensen was one of the first to make the change. When he founded his company in 1991, he purchased a UNIX-based solid modeler. "The die design business was then, and still is, primarily 2D," Christensen says. "But 3D modeling of a tool produces information that is more accurate and useful than 2D design. And there are significant time savings available once the model is done. For example, a large die will typically have twenty or more parts that require 3D machining. If an NC programmer has to spend a day or more for each part creating complex 3D geometry from interpreted 2D data, that's an additional 80 to 160 hours required for NC programming that isn't needed when 3D design geometry is used. Working from design data also decreases the chance of errors caused by misinterpreting 2D data."

In 1996, Christensen upgraded to a Windows-based program, Solid Edge from Unigraphics Solutions, mainly as a way to lower the cost of CAD ownership. "Using a Windows program eliminates the need for multiple computers or rebooting into a different operating system to run office applications," Christensen says. Another benefit is that when he gets busy and needs to hire temporary help, it's possible to find someone who can operate Solid Edge.





12-Station Die Shows Benefits of 3D

The 12-station progressive stamping die that Summit Tool Design recently created for a U.S. Tier 1 automotive parts supplier, provides a good illustration of the benefits of working in 3D. The client gave Christensen an IGES file – a single-sided surface model – of the finished part. After importing the file into Solid Edge, Christensen's first step was to convert this shape into a solid model of the finished part. Using the client's design as a template, he built the solid model using both the Solid Edge Part and Sheet Metal environments. He used the "construction surfaces" tools in the Part modeling environment to obtain the graceful curves of the finished part. Solid Edge Sheet Metal provided him with functionality specific to sheet metal, such as forming flanges, that is not supported by basic solid modeling tools.

After he created the finished part as a solid model, Christensen used the Sheet Metal environment's automatic unfolding capability and the construction tools from Solid Edge Part to create a strip layout. This was the starting shape of the metal around which he would design the rest of the tool. Christensen then created the die itself. Its first few stations cut away pieces of metal to define the shape of the flat blank. A pre-form station and a trimming operation to further refine the part shape follow. Next there are additional forming stations, a cam pierce operation and then final forming and cutoff operations. The die performs this sequence on two parts at a time.

Key Benefits for Summit Tool Design

- The use of 3D ensured accuracy in the finished tool.
- Solid Edge increased detailing productivity by 25%.
- Built-in data management capabilities allowed the second and third dies to be completed in less than one-third the time it took for the first.

Using Solid Edge's assembly modeling environment, Christensen worked within a subassembly for each die station, modeling the individual parts, or pulled them from an existing part library. Although he mostly worked with subassemblies, he did create a file that contained the entire die assembly, with its 576 unique parts and 2,338 total parts.

While building sub-assemblies, Christensen took advantage of the visualization provided by 3D to find and fix any problems in the design. For external regions of the model, he could check for interferences simply by shading components and rotating the model to look at it from different directions. For internal regions, he used the software's automatic interference checking capability. Using both methods, Christensen was able to prevent potentially costly problems that formerly might not have been found until manufacture.

Once Christensen had an accurate assembly model, he began to produce the 180 detailed drawings he would supply to the shop. "This is where the 3D approach really paid off," Christensen says. He found it so easy to spin off drawings from the solid model that he produced isometric views and other supplementary views that would have been impossible to draw from scratch in a 2D system. "Once I had the model, I could generate as many drawings as I needed, without a significant increase in time, to help the people in the shop understand what they were going to build," he adds.

Solid Edge increases Christensen's detailing productivity by 25% over his previous UNIX software. In addition to saving overall design time, he is able to release the sub-assembly of each station for detailing as soon as the customer has given approval. He can do this with confidence, knowing he will be able to easily update any detail drawings that have already been completed. This helps to shorten the overall lead-time of a project. More importantly though, is the quality of information provided.

After the first die design was completed, it was used as the master to design two additional 12-station dies for parts with slightly different sizes and contours. Using the built-in data management capabilities in Solid Edge Revision Manager, he was able to re-use much of the work done for the original design and complete the second and third dies in less than one-third the time it took for the first. More importantly the work was much more accurate. "It's very time-consuming and costly to recover from an error on the shop floor," Christensen says. "With 3D I can help make sure that doesn't happen."

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