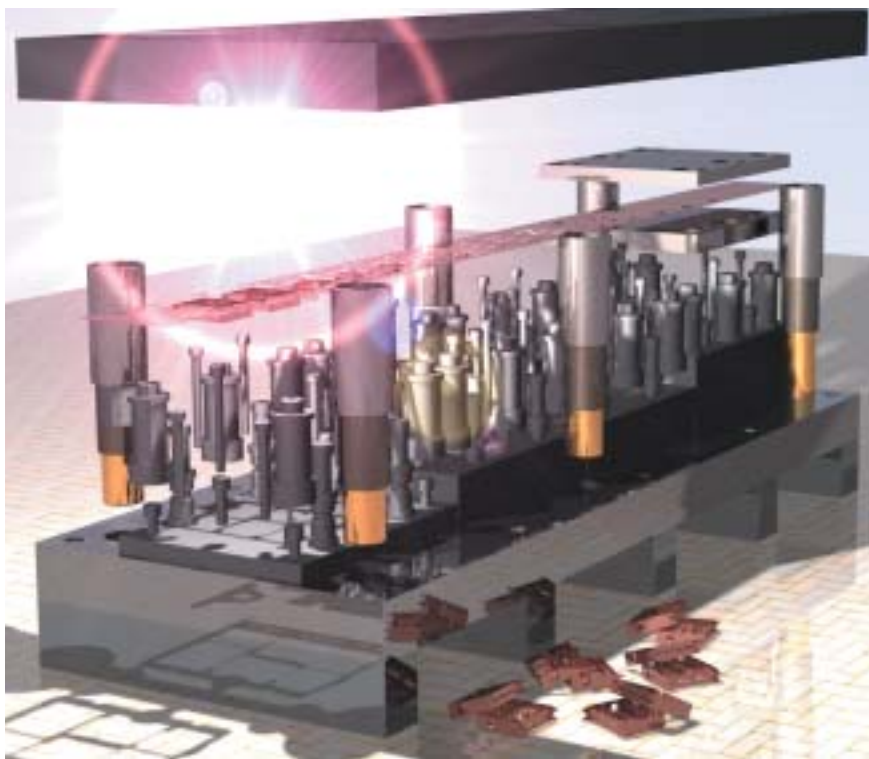


3D Design for Complex Prog Dies



Wiegel Tool Works recently made the switch from 2D to solid modeling, cutting design time by a third.

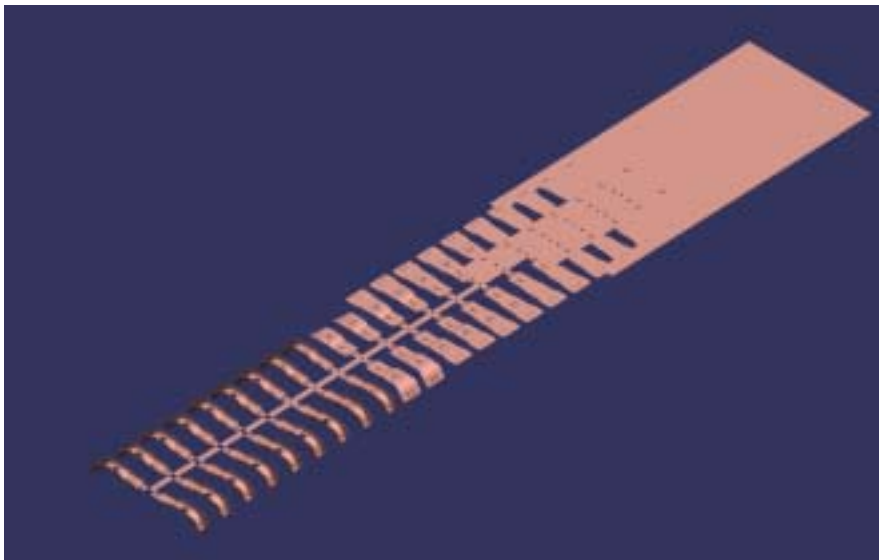
BY LOUIS A. KREN, SENIOR EDITOR

Progressive-die design in 2D is a workable option, provided that highly skilled engineers stay on top of their game throughout the process. The need for complex high-precision dies stretches those skills further and lengthens the time needed to furnish a die set that will make parts to spec from the first hit.

That is where the engineering department at Wiegel Tool Works, Inc., Wood Dale, IL, found itself in 2001. The team employed 2D CAD software to design sophisticated die sets that would likely find a home in one of Wiegel's production presses. But with customers demanding shorter lead times and tighter part tolerances in addition to more complicated tooling, the company looked to solid modeling. Also driving the proposed change: More customers began supplying 3D part files.

After an extensive search, Wiegel contracted with EDS PLM Solutions, Plano, TX, for two seats of Unigraphics NX solid-modeling software for the engineering department and one seat for machining-center operators. Of chief interest to the engineers was the software's Progressive Die Wizard, offering flat-blank and strip layout and internal component catalogs, among other features, to allow 3D design of progressive dies.

Established in 1941, Wiegel Tool Works operates with 50 employees out of a 48,000-sq.-ft. facility, doubling in size from just four years ago. Born strictly as a tool-build shop, Wiegel gradually entered into what is now the company's strong suit: contract stamping. About 90 percent of the tooling Wiegel



Wiegel Tool Works uses the 3D strip-layout feature in its Unigraphics NX Progressive Die Wizard to accurately break a file of a complete 3D stamped part into a forming progression, aiding greatly in rapid, accurate design of progressive-die tooling. Incorporating the software has, by Wiegel estimates, cut die-design time by a third.

designs and builds is run inhouse on presses ranging from 30 to 400 tons, producing parts primarily from 0.002 to 0.060-in.-thick nonferrous materials. Besides stamping parts in medium to large runs for automotive (30 to 40 percent), communications and industrial-motor customers, the company also performs prototype work.

2D Design Doable, But...

Working with 2D CAD software since 1987, Wiegel engineers produced needed tooling plans, but in recent years more and more parts were arriving as solid-model files.

"Three years ago, we started looking at a solid-modeling program that at least would allow us to open these files and look at the parts," recalls Andrew Niewiara, Wiegel engineering manager.

Wiegel engineers found that 2D design made it difficult to visualize interactions among die components. On top of that, numerous production-level drawings, some with as many as 120 details, were needed to communicate design specifics to the inhouse tool builders. This added greatly to design time and, with such a lengthy straightforward process, Wiegel engineers found less opportunity to apply their experience and to tinker in order to improve designs.

Faced with these challenges, the engi-

neering department came across Unigraphics NX CAD software, learning that EDS engineers were working on something called Progressive Die Wizard to complement the suite.

"That drew our interest because five years prior, EDS introduced Mold Wizard, which we thought highly of," recalls Niewiara.

Two years ago, convinced that Progressive Die Wizard would live up to the

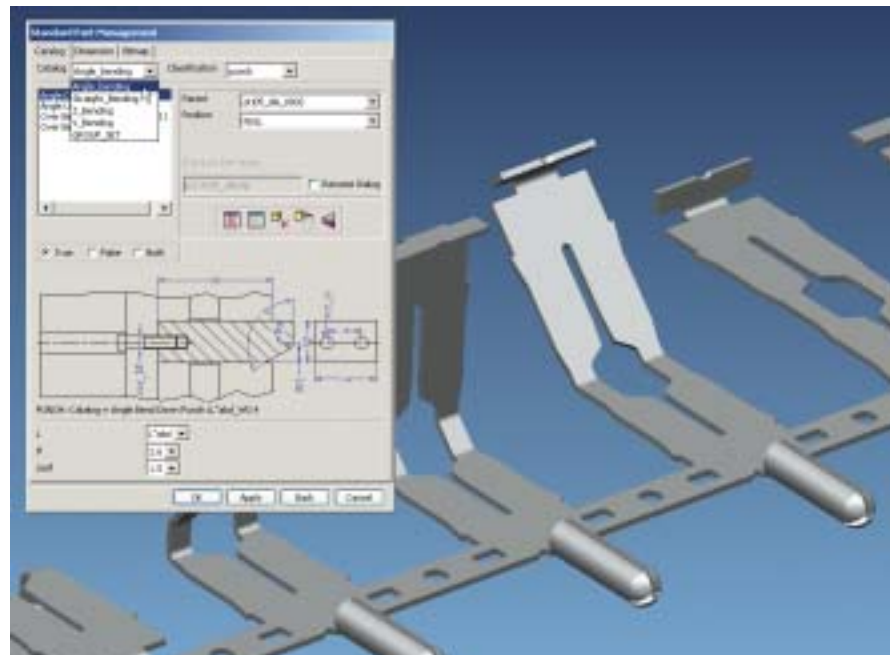
reputation of its Mold Wizard predecessor, Wiegel purchased NX software seats containing the Progressive Die Wizard module.

After traversing the learning curve and working closely with EDS engineers in California, this past spring Wiegel shifted all of its design work into Unigraphics NX and Progressive Die Wizard. To date, Niewiara estimates that the new software cuts one-third off the time needed for die design and delivers accurate tooling and all of the needed details that automotive customers demand.

"Now, all of our dies are fully detailed," he explains. "In the long term, die drawings must stand on their own, especially in automotive, which has very strict die-design conventions. For those customers, the designs must be graphically pure, with each detail standing on its own. And 3D makes it much easier to show detail."

From Part to Tool

Wiegel engineers begin the die-design process by opening a 2D or 3D part file in the Unigraphics software. Then Progressive Die Wizard takes over,



The Progressive Die Wizard in use at Wiegel features drop-down menus for various in-die processes to assist Wiegel engineers in assigning operation stations in progressive dies.

Tooling Technology

unfolding the part into a flat blank. The software guides the engineers through determining optimum blank layout on sheet, followed by scrap layout where users determine what and where cuts are made, and account for over and undercuts. All through this, the module automatically takes actions to minimize scrap, saving engineers from making cumbersome calculations. Optimal material utilization is extremely important at Wiegel, where customers often specify parts made from higher-priced nonferrous materials, many with precious-metal plating.

With blank layout complete, the software's strip-layout capabilities guides engineers through placement of process features and allows them to add and drop stations.

Once generating the strip as a 3D model, the software runs simulations to ensure that all processes result in the correct finished part. After the correct part is realized through simulation,

Andrew Niewiara, engineering manager at Wiegel, estimates that as his staff becomes more proficient with its 3D die-design software, it ultimately will cut 50 percent off design time as compared to working with its old 2D-design methods. The software also helps slice manufacturing time as a CAM module directly translates software-generated 3D models into precise toolpaths for CNC machining. Previously, manufacturing engineers at Wiegel had to recreate 3D data for toolpaths from 2D engineering drawings supplied by the die-design team.

engineers use the wizard's customizable libraries to drop in appropriate bases, pins, bushings, perforators and other die components. Whatever is dropped into one area automatically is accounted for in all other areas of the tooling, with scrap generated in the scrap-layout portion of the wizard driving punch sizes.

"Based on the scrap layout," explains Niewiara, "Progressive Die Wizard is



smart enough to determine the right thicknesses of the die block, backup plate and die shoes, for instance, and what clearances are needed on tapers and openings. The software generates the openings in the die plates. Suppose we have to anchor a punch plate and

backup plate to the top shoe. When we drop a screw from the top of the die set and subtract that screw from the die assembly, the software automatically creates a tapped hole in the punch plate, a clearance hole in the backup plate and a counterbore hole in the die-set top. The holes always line up perfectly. With 2D design, we would have to access reference drawings and spend a lot of time and effort to make sure everything lined up.”

The addition of an NX seat for machining-center operators lets them make use of the NX CAM module to create toolpaths directly off of the 3D model. This eliminates possible mistakes with recreating data. Previously, Wiegel manufacturing engineers would import 2D tool-design drawings from the tool engineers to recreate the data in 3D for toolpaths. That switch, estimates Niewiara, has reduced the company’s CNC-programming time for tooling by 25 percent.

Easier with Practice

Like anything else, experience is key to getting the most out of the NX Progressive Die Wizard.

“We have worked closely with the EDS office in Chicago and with its engineers in California in using the software to incorporate features into our complex tooling,” offers Niewiara. “We make a lot of tooling for complex parts, with different forms and cutouts, that find use in insert-molding applications. Dimensions are critical for these parts, on the order of ± 0.0005 in. With solid modeling, we can see what material we are taking out and as we build the tooling, the software accurately lines up holes and places components. In addition, in the background the software generates the accurate drawings that our customers demand.”

Niewiara expects that, in time Wiegel will reduce design time by 50 percent as compared to its old 2D design methods.

Besides assisting in ultimately creating precise complex parts and reducing design time, the software has eased tryout challenges at Wiegel.

“Because we can see so much of what is going on in the tooling while we are building it, we have minimized tryout time” says Niewiara, noting that the company makes use of toolroom tryout presses as well as production presses to test tooling.

An added bonus: the software enables far more accurate costing and quoting at Wiegel. Niewiara expects further efficiencies with the recent release of Uni-graphics NX 2, with an upgraded Progressive Die Wizard.

“With the 3D visualization we have now and the time we save through automation,” he offers, “we can produce the best dies that we can envision. And the better the tooling, the higher the quality of the stamping, which ultimately is what our customers want.”

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