



The most powerful CAM software ever.



## New Methods and CNC Software Reduce Programming, Setup and Machining Time

by Jerry Fireman

Paper Converting Machine Company (PCMC) programmers experienced difficulties using 2D computer numerical control (CNC) programming software, such as the inability to verify the program on the computer.

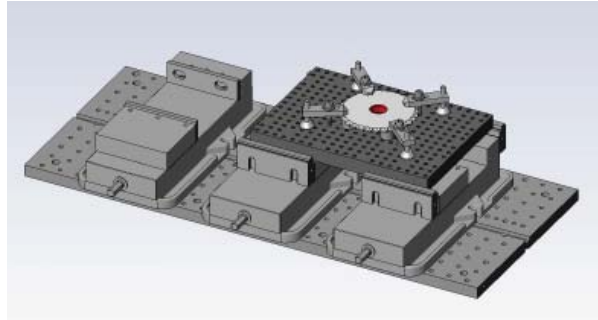
In search of a solution, the company switched to solid-model based CNC software that provides a realistic view of machining operations. The new software also offers knowledge-based machining capabilities that make it possible to automatically apply predetermined optimized machining processes to each feature of the solid model. "The knowledge-base features of the new software have substantially reduced programming time," said Daniel Parry, Manufacturing Engineering Technician Specialist. "Setup time is reduced because of our ability to verify the program in the software. Finally, the ability to optimize and standardize machining processes has resulted in machining time reductions."

Headquartered in Green Bay, Wis., PCMC designs and manufactures converting machinery for the tissue, flexible packaging and disposables nonwovens industries. In addition, PCMC manufactures a complete line of wide web flexographic printing systems, coating and laminating machines and narrow web in-line printing systems. PCMC currently has seven facilities in the United States, United Kingdom, Italy, Germany, Brazil and Japan, and employs over 1,500 people worldwide. Previously, using 2D CNC programming software, the company exported wireframe or 2D geometry from its computer-aided-design (CAD) software and imported it into the programming software. The programmer then assigned tools to various features of the geometry to generate toolpaths. The lack of solid geometry meant that it was not possible to verify the program three dimensionally or to provide machine operators with realistic documentation. In the past, set-up sheets contained minimal information.

### Upgrading to latest CNC technology

PCMC decided to upgrade to the latest 3D CNC programming technology. One of the main reasons they picked ESPRIT® from DP Technology among several solid model based CNC programming systems because of its advanced knowledge base machining capabilities. "ESPRIT is capable of importing a SolidWorks model, recognizing the features and automatically pulling from a library of standard machining processes to machine specific features," Parry said. "This saves time and provides the potential to standardize and optimize machining operations across our full range of machines (Vertical and horizontal milling machines, turning and

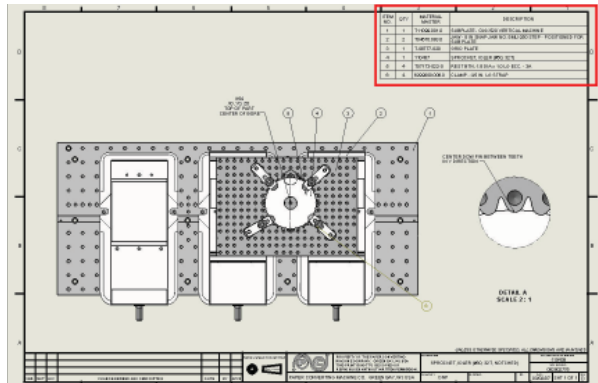
mill-turn machining centers). PCMC has taken full advantage of the capabilities of ESPRIT to develop a CNC programming process that achieves the elements that



SolidWorks® assembly for vertical machining center

are important to the organization. The first step is creating a solid representation of the set-up necessary to machine the job at hand by selecting components from a SolidWorks® design library which contains the set-up assemblies that are available to the operator running the machine. The purpose is to provide an accurate simulation of the program, not only for programmers but for the person running the job on the shop floor.

Programmers then create a set-up sheet which links to the SolidWorks assembly and contains all pertinent



SolidWorks set-up sheet

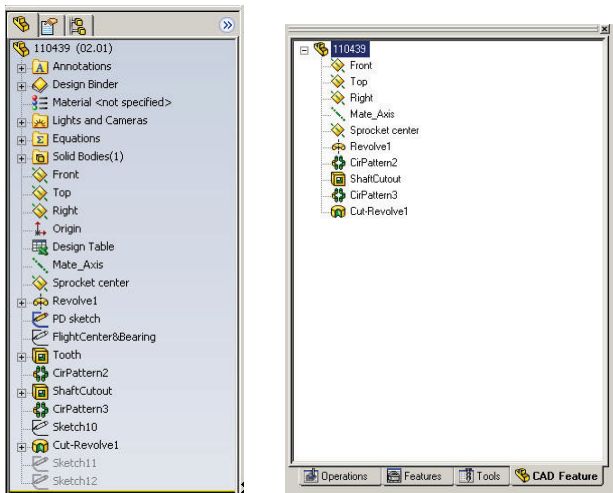
information about the job. CNC programmers output an official drawing using an engineering drawing template

Passion | Vision | Commitment | Power | Performance | Value



that contains all necessary proprietary information for it to be treated as a legal document within and outside of the organization. These drawings include all information about part origins and program zero positions, specific notes that will make things progress more smoothly during set-up and also information about the part being machined (e.g. part name, part number, program number, who programmed the job, etc.).

“The parametric and associative capabilities of native SolidWorks drawings mean that if something within the setup changes, as it often does, the operators and programmers can be certain that their set-up drawings will reflect the changes and illustrates them through the revision blocks located at the bottom of the drawing,” Parry said.



SolidWorks feature tree (left) and the same feature in ESPRIT

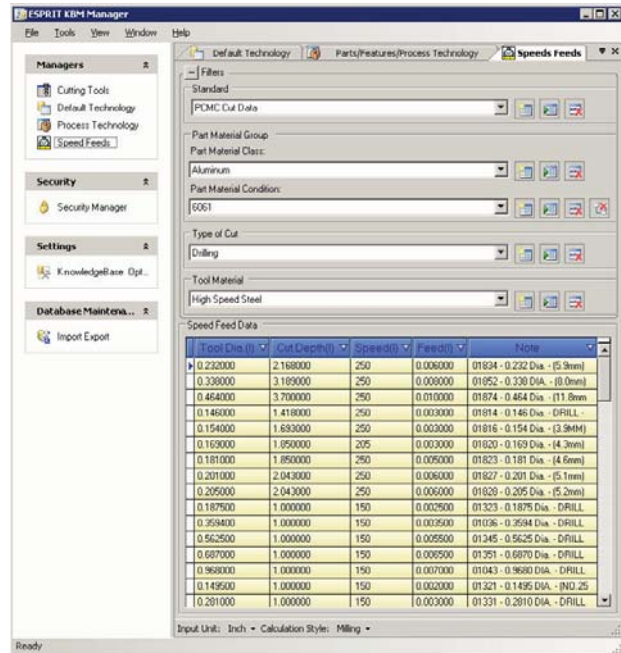
### Feature recognition

The next step is to translate the SolidWorks set-up assembly and part to be programmed into ESPRIT. ESPRIT then uses knowledge-based machining methods to automatically organize the geometry into features that normally correspond to machining operations, such as pockets, islands, bosses and grooves. The software organizes these features into a tree that includes the machining operations needed to produce them. Rather than having to perform this work from scratch, PCMC’s programmers simply review the features and, in many cases, edit or re-arrange them in order to better suit the company’s machining methods.

“The feature tree is visible through the CAD tab on the process manager, which is extremely beneficial for many reasons,” Parry said. “By obtaining the feature tree on a particular model, we have immediate access to the same information used by the designer to create the model. For example, a 1/4 -20 threaded hole is no longer just a cylindrical shaped cutout on a solid body, as it would be

when viewed in our legacy CAM systems. With ESPRIT’s FX capabilities, the software and the user immediately know what the feature’s name was in SolidWorks, the standard of the hole (ANSI Inch, ISO, etc.), the thread class, thread depth, tap drill size and depth, which fastener we use for this size hole and any other information that can be carried over from the Hole Wizard command in SolidWorks.

“In the past, when a user brought a solid model in, it was just dumb geometry. It did not retain any specific



ESPRIT’s KnowledgeBase™ interface

information about the features. The programmer had to explain to the software specifically what the features are through chains (templates for tool path).”

### Knowledge-base

“PCMC is currently in the process of creating a knowledge-base that is filled with attributes which are unique to our company,” Parry said. “We are teaching the software how PCMC cuts metal – what materials we have, what tooling we use and how we use them. Our goal is to be able to bring a SolidWorks model into ESPRIT, recognize the features and have it automatically pull from a library of standard machining processes to machine a specific feature.”

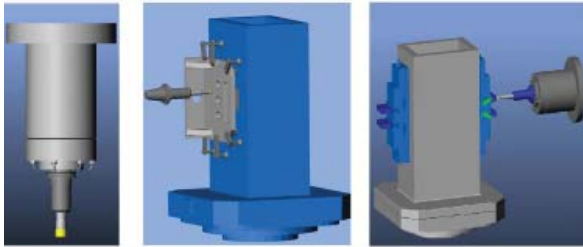
When a programmer creates a new CNC program, he can simply drag and drop machining operations from the library rather than creating them from scratch. In addition, programmers have worked to maintain the library by modifying operations based on feedback from machine



operators and other sources. As a result, the library has become optimized as the knowledge of programmers, engineers and operators has become embedded in it.

Using the 1/4-20 hole example, the software first recognizes the hole. Secondly, the programmer uses the process manager command to have ESPRIT search the library for the processes that pertain to this particular feature. ESPRIT then produces separate operations for spot drilling, drilling and tapping process. Along with these operations, the software brings back the necessary tooling with speeds and feeds attached. Depths and clearances are automatically read from the solid model.

“The PCMC team has currently developed all standard and preferred tooling inside of ESPRIT, including speeds and feeds, for the machines that we presently support,” Parry said. “We support all vertical machining centers, as well as three horizontals. We have all of the necessary ESPRIT templates available for these machines, which contain all predefined parameters for a specific work center. We have modeled the standard work holding components for these machines and made them available through the SolidWorks design library where a user can preview a component or standard set-up before they create the assembly.”



Horizontal machining center simulation

“With ESPRIT’s KnowledgeBase, programmers and operators will benefit from consistency in all aspects of what it takes to machine a part,” Parry said. “Tasks that used to take hours – like creating features on a model or deciding which tooling to use – are now automatic. An important future goal for the manufacturing engineering department at PCMC is to free up programmers so that they can focus on other ways to save and make the company money, such as process improvement and set-up reduction.

### Simulating Machining Operations

“Accurate simulations save valuable programming time by simulating clearance issues, tooling problems and many other tribulations which previously could not be seen until the program was already in the machine,” Parry said. “The simulations also reduce set-up time by allowing the operator to see what the program is going to do before they load it into the control; therefore reducing dry-running time. Since the operators view the simulation through a demo mode of ESPRIT, they have the same detailed information available to them as the programmers. Cycle times, tool lists, rotational views, coordinate and work plane information is only a click away.”

“ESPRIT has become the standard CAM software here at Paper Converting Machine Company,” Parry concluded. “Our two older 2D CAM software packages are being phased out as we bring on more programmers and support more machines. So far, our journey has been very encouraging. We make continual progress and leave each day with a sense of fulfillment. As new functionality and stronger support from DP Technology continues to thrive, we are constantly reminded that, to quote ESPRIT’s slogan, we made the “right choice.”

**This article appeared in the February 2008 edition of *Tooling & Production* magazine.**