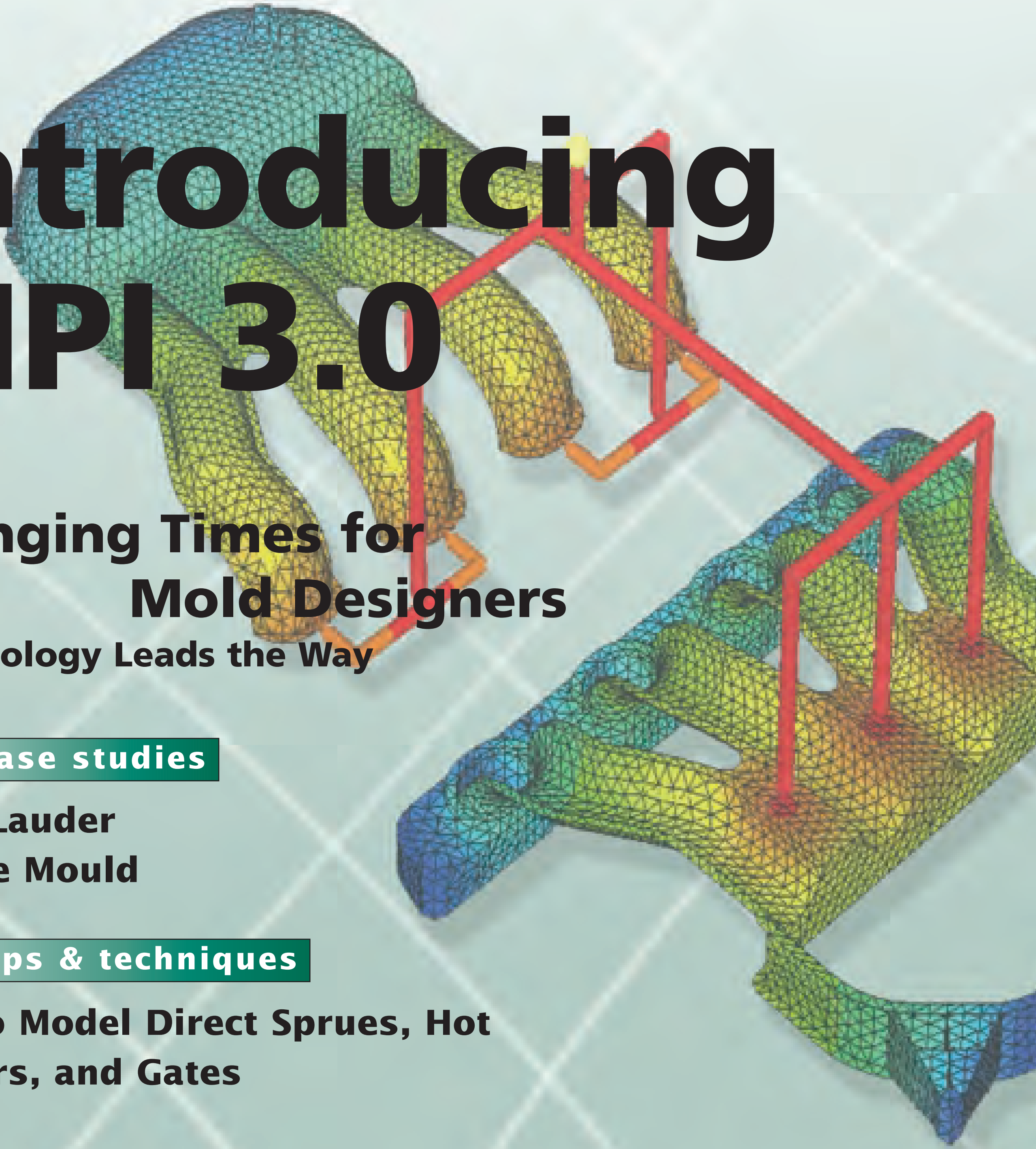
September 2001

Flowfront

The Magazine of Choice for Moldflow Plastics Professionals



Introducing MPI 3.0

Changing Times for Mold Designers

Technology Leads the Way

case studies

Estée Lauder

Avenue Mould

tips & techniques

How to Model Direct Sprues, Hot Runners, and Gates

www.moldflow.com

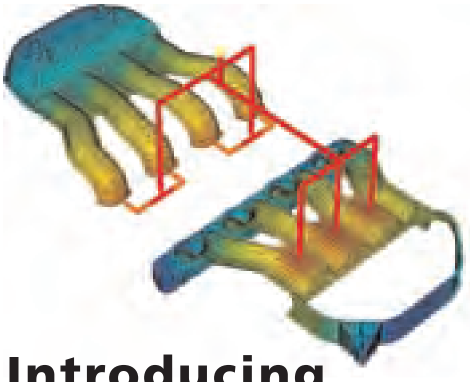
Vol. 1, Issue 1 2001

contents

FEATURES

COLUMNS

DEPARTMENTS



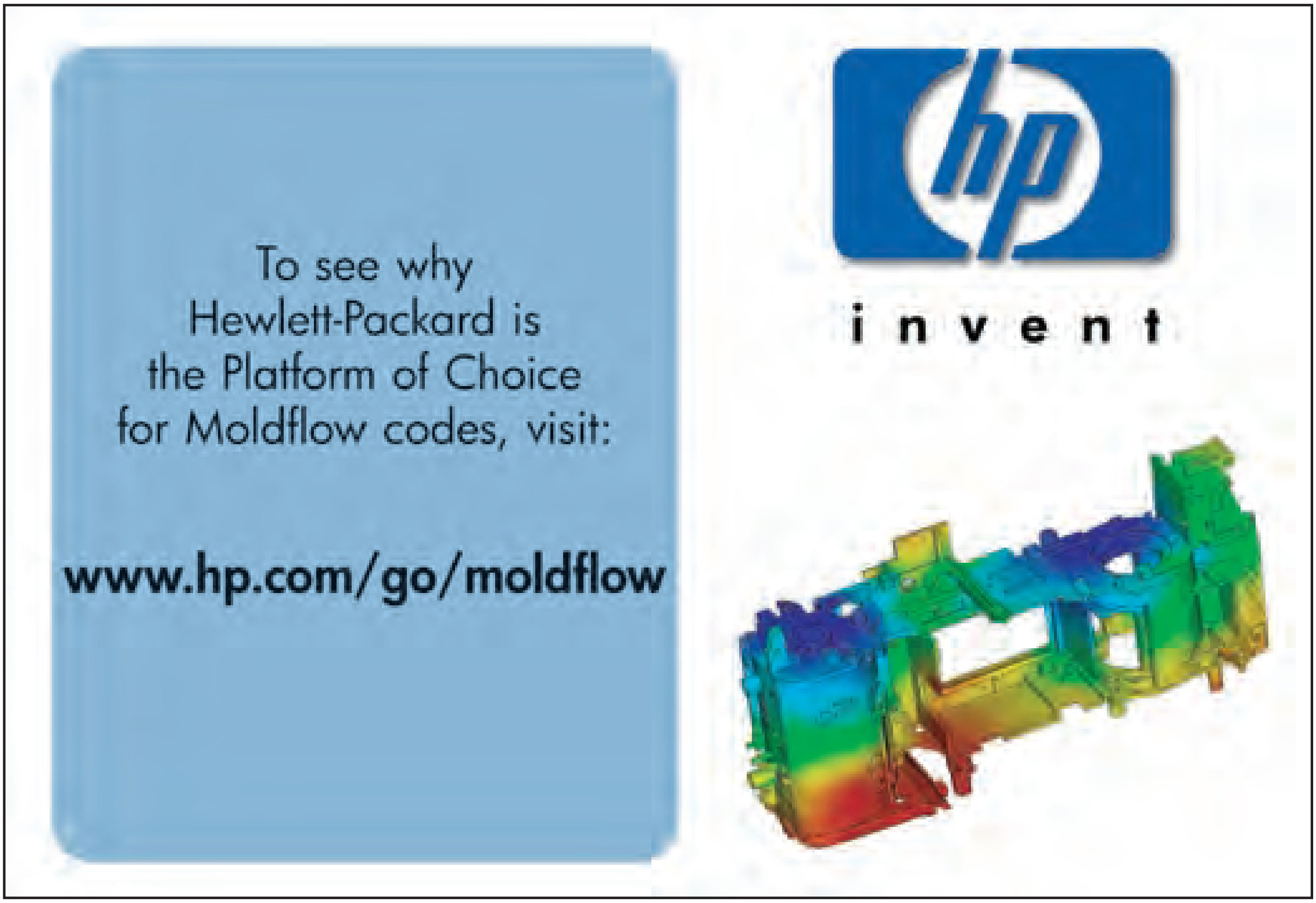
Introducing MPI 3.0!

Manufacturing Solutions for Injection Molding

Flowfront

For more information, contact us at:
Tel: 508-358-5848
Fax: 508-358-5868
Web: www.moldflow.com
Email: flowfront@moldflow.com
Mail: 430 Boston Post Road
Wayland, MA 01778
Editor: Laura Carrabine
Copy Editor: Marcia Swan
Designer: Joanna King

moldflow


To see why
Hewlett-Packard is
the Platform of Choice
for Moldflow codes, visit:
www.hp.com/go/moldflow
hp
invent


Bob "The Conqueror" Carson: Assembly machinery
Harry "Hercules" Adams: Ski equipment
Steve "Invincible" Thomas: Medical instruments
New SolidWorks Office.
More than a great value, it gives you quite a powerful feeling.
You can do it all. Now everything you need to beef-up your productivity and add more muscle to your presentations is in your hands. You are the product designer with all the tools: ▪SolidWorks® 3D CAD software ▪PhotoWorks™ ▪SolidWorks Animator ▪3D Instant Website ▪SolidWorks Toolbox ▪FeatureWorks® ▪SolidWorks Utilities. You have all the power in one very affordable package. SolidWorks Office, the complete 3D CAD solution. Find out more, big guy.
Log on to: www.solidworks.com/flowpower or call 1-800-693-9000 ext. 3556.
SolidWorks®
©2001 SolidWorks Corporation. SolidWorks and the SolidWorks logo are registered trademarks and PhotoWorks is a trademark of SolidWorks Corporation.
FeatureWorks is a registered trademark of Geometric Software Solutions Co. Limited. All other company and product names are trademarks of their respective owners.

Welcome

Dear Readers,

Welcome to the first edition of the new format of Flowfront. Flowfront begins its life cycle as a semi-annual publication with an issue targeted for spring and fall of each year. Each issue contains a myriad of compelling articles that are focused on technology, academic and R&D breakthroughs, and industry trends and issues. This new magazine format allows us to get more in depth on each topic we cover.

Flowfront, unlike other publications that briefly touch on issues important to injection molding professionals, will explore these topics more deeply and help our readers find solutions to the problems they face every day. For this to happen, we need contributions from our readers. We are always on the lookout for interesting application stories, topics of industry interest, and articles discussing technology and automation. If you feel that you have a topic or story to contribute, we encourage you to contact us.

Moldflow product line manager Dean Piepiora explains Moldflow's exciting new Synergy technology inside Moldflow Plastics Insight 3.0. Synergy is a powerful new pre- and post-processor for model preparation and cleanup, as well as for viewing and manipulating analysis results. The technological breakthrough integrates the best features of Moldflow Plastics Insight (MPI) and C-MOLD 2000 (CM2K) products into a single, merged product family. Also in this issue, product line manager Peter Rucinski offers insight to Moldflow's Manufacturing Solutions for automating, controlling, and monitoring injection-molding processes. He gives full, updated descriptions of Moldflow Plastics Xpert, Moldflow Shotscope, and Moldflow EZ Track manufacturing software solutions.

Each edition of Flowfront will feature innovative commentary authored by Moldflow customers and partners, as well as Moldflow resources. In fact, each month guest author and Gartner Group research director Marc Halpern, Ph.D., will offer his overviews of CAD/CAM/CAE, plastics engineering, e-commerce, and the supply chain. In this issue, he addresses the need for manufacturers and suppliers to develop collaborative product commerce (CPC) networks.

As you will see in this issue, Moldflow customers Avenue Mould (Sligo, Ireland) and Estée Lauder (New York, NY) offer insights as to how these world class manufacturers are using Moldflow products to reduce product development lead times, enhance product quality, and win industry awards! Each Flowfront edition will contain exclusive customer success stories from applications around the world. If you would like your application featured in an upcoming issue of Flowfront, please contact me at laura_carrabine@moldflow.com.

Also in this issue, Barr Klaus, vice-president of technology at Milacron, Inc., comments about how Milacron is responding to the global energy crisis in the Executive Spotlight. This column is a forum for senior management to discuss industry trends, solutions to problems, and what's on the horizon in terms of new technology. In his commentary, Mr. Klaus explains how all-electric injection molding machines can help save manufacturers millions of dollars in terms of conserving energy and why the benefits of converting to all-electric far outweigh the costs of retaining inefficient equipment.

Professor Robert Malloy of the Plastics Engineering Program at the University of Massachusetts Lowell provides an interesting historical overview of the Plastics Engineering Program at the school. From its humble beginnings in 1895, the program today is rich in technology and resources. Support and endowments from outside sources such as Moldflow and Milacron are testament to the program's success.

This issue of Flowfront also provides tips and techniques for using Moldflow Plastics Advisers (MPA) 5.0 design-for-manufacture analysis software from product line manager Murali Anna-Reddy. Using MPA tools, designers can test every part and mold concept for manufacturing feasibility before the tool is cut, when the cost of change is minimal.

ProMold's sales and engineering manager, Scott Peters, tells us how the role of mold designer has changed over the course of his career. From overpaid draftspeople to valued team members, Scott says that technically savvy mold designers today are key to a manufacturer's success.

Soon, Moldflow will open its Center for Professional Development. Stephen Thompson, Moldflow's global training manager, explains why the facility came to be and how it will be used. The Center is a corporate university that is being developed for Moldflow customers to help empower their Moldflow users.

Enjoy this first issue. We are excited to bring you the latest news and technology via this format. We welcome reader input and encourage you to submit article ideas, suggestions, and comments about what you like and don't like about the publication. If you have software tips and/or techniques that you would like to share, please do. Send your feedback to laura_carrabine@moldflow.com.

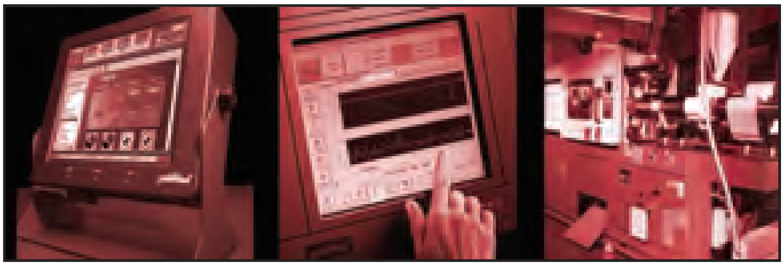
Laura Carrabine

Laura Carrabine
Editor

Focus on

Moldflow Manufacturing Solutions for the Automation, Control, and Monitoring of the Injection Molding Process

By Peter Rucinski, Moldflow Corporation



Molders today are constantly in the search for ways to squeeze inefficiencies out of every step in the manufacturing process. The pressure to reduce downtime and scrap, leverage the know-how of experienced die-setters, and implement systems that maximize the productivity of every machine and every operator at every site, regardless of location, is constant. Increasingly, this industry is turning to technology to provide the solution to their problems.

Custom and captive injection molders wanted a suite of products from one global supplier that would provide injection molding manufacturing personnel with all the tools necessary for scheduling, setup, optimization, control, and reporting of the injection molding process. Specifically, customers pointed out that existing molding practices often resulted in:

- ❑ Inefficient scheduling of mold, machine, and labor resources.
- ❑ Long process setup times and associated scrap.
- ❑ Non-optimized cycle times.
- ❑ Unacceptable molded part quality.
- ❑ Unacceptable production scrap rates.
- ❑ Poor or inconsistent control of the molding process.
- ❑ Lack of part traceability.
- ❑ Lack of manufacturing management information.

Moldflow's Manufacturing Solutions products address all of these problems with scalable solutions that will work for small, custom injection molders, and large, multi-national corporations.

Plastic injection molding

The plastic injection molding process is integral to many of today's mainstream manufacturing processes. Industries such as telecommunications, consumer electronics, medical devices, computers, and automotive all have large, constantly increasing demands for injection molded plastic parts. In addition, these industries continually must decrease time-to-market as product life cycles are being compressed.

While demand for injection molded plastic parts is increasing, the problems associated with the process often can cause significant time delays and cost increases. This is because the injection molding process is a complex mix of machine variables, mold complexity, operator skills, and plastic material properties. In addition, there are constant pressures to reduce mold setup times and scrap, improve part quality, and maximize the productivity of every injection molding machine. Due to these pressures, it is becoming increasingly important to have systems in place to allow the molding process to be scheduled, set up, optimized, controlled, and monitored using an intuitive, systematic, documentable, and globally supported methodology.

Intuitive — so machine operators can maximize productivity by not having to be experts on every machine/mold combination they are responsible for running.

Systematic — so the process of setting up and optimizing the molding process can be done with a scientific method that does not rely solely on the skills of the machine operator.

Documentable — to meet the strict quality control reporting requirements that are commonplace today.

Globally Supported — so that large, multi-national corporations can source these solutions from one supplier and implement company-wide standards across their enterprises.

In response to market feedback regarding these pressures and existing plastics manufacturing practices Moldflow Corporation has developed a complete suite of Manufacturing Solutions for the automation, control, and monitoring of the injection molding. These products consist of:

Moldflow Plastics Xpert — a process automation and control system that decreases mold setup time, cycle time, and scrap; and improves molded part quality and labor productivity.

Shotscope — a process monitoring and analysis system that collects critical data in real time from the injection molding machine and then records, analyzes, and reports on that data.

EZ-Track — a real time production monitoring and reporting system that can be attached to virtually any cyclic manufacturing equipment.

Moldflow Plastics Xpert

Throughout the injection molding industry today, the number of molds that must be set up and optimized for high-volume part production is far outpacing the number of process engineers or trained technicians qualified to do so. It is not uncommon for a molding operation to have a small number of individuals who have the education or experience to set up the injection molding process. And, even those who can set up the process often do not have time to optimize it due to production pressures. This scenario results in problems such as long process setup times and associated scrap, non-optimized cycle times, unacceptable molded part quality, unacceptable production scrap rates, and poor or inconsistent control of the molding process.

> While demand for injection molded plastic parts is increasing, the problems associated with the process can often cause significant time delays and cost increases.

Moldflow Plastics Xpert (MPX) process automation and control technology provides machine operators with an easy-to-learn and easy-to-use tool for the setup, optimization, and control of the injection molding process. MPX allows a less-experienced operator to set up molds, optimize the process, and control production.

MPX functionality is arranged into three modules

I: The Setup Xpert module allows users to perform a variety of injection-velocity and pressure-phase-related setup routines to fix certain defects, such as short shots, flash, burn marks, sink marks, etc. Setup Xpert helps users achieve one good molded part with no defects. A user molds a part, then provides feedback to the MPX system regarding molded part quality. MPX processes this feedback along with data being collected from the machine and (if necessary) determines a process change that will improve the result.

After completing Setup Xpert and determining a combination of processing parameters that results in a single, satisfactorily molded part, the user still does not know if these parameters are within a robust processing window. For example, any process parameter drift or variation could easily result in parts of unacceptable quality. In the injection molding process, variation is inherent. Whether the material, machine, process, operator, or environment causes it, there will always be some variation. This variation may or may not result in the production of bad parts. The variation is normal, so the processing window must be robust enough to compensate for it without producing bad parts.

Design of experiments (DOE) is a useful tool in determining a robust processing window. The process window is defined as the maximum amount of allowable process variation — allowable, because it will not result in the production of bad parts. However, the historical perception of DOE is that it can be complicated, resulting in extensive training requirements and costs for those responsible for running it. DOE is also time consuming, thus increasing the time required to put a given mold into production.

II: Optimize Xpert is an automated design of experiments (DOE) that can be run quickly and easily. The software does not require any special training in statistical process control. The goal of using Optimize Xpert is to obtain a robust processing window that will compensate for normal process variation and ensure that acceptable quality parts are produced consistently.

While the Optimize Xpert DOE is automated, easy to use, and relatively fast to complete, it is far from simple. There are five process parameters that can be used as DOE factors: packing pressure, mean (or average) injection velocity, velocity stroke, packing time, and cooling time. In addition, there are a number of molding defects that can be used to measure part quality criteria, including short shots, flash, sink marks, burn marks, poor weld line appearance, weight, dimension, and warpage problems.

Assuming a robust processing window is determined using the Optimize Xpert, control mechanisms are still required to make sure that the process stays within its specified limits.

III: Production Xpert is a comprehensive process control system that maintains the optimized processing conditions determined with Optimize Xpert. Production Xpert allows the user to maintain the production process consistently, resulting in reduced reject rates, higher part quality, and more efficient use of machine time. If desired, Production Xpert will correct the process automatically should it drift or go out of control.

There are still many functions required in a manufacturing operation, including production scheduling, process monitoring, statistical process control (SPC), statistical quality control (SQC), scrap tracking, production monitoring and reporting, preventive maintenance scheduling, and more.

Moldflow Shotscope

The Moldflow Shotscope process monitoring and analysis system is a comprehensive product suite that collects critical data in real time from molding machines on the factory floor. The software then records, analyzes, reports, and allows access to the information for

Focus on

use in critical decision making. Additionally, the product can be used for both plastic injection molding and metal die casting operations.

Shotscope allows molders to maximize their productivity by providing necessary tools to schedule mold and machine resources efficiently. The software also monitors the status and efficiency of any mold/machine combination. By monitoring the efficiency of a given mold/machine combination, molders can schedule jobs based on a number of criteria, including minimum cycle times, highest production yields, and so on. Users also can define periodic maintenance schedules for molds and machines, and, after a pre-determined

number of cycles or operating hours, Shotscope will signal that preventative maintenance is required.

Shotscope also maintains and displays statistical process control (SPC) data in a variety of formats, including trend charts, X-bar and R charts, histograms, and scatter diagrams. This information provides molders with the knowledge that their processes are in control, and, should they go out of control, Shotscope can alert to an out-of-control condition and divert suspect-quality parts. Furthermore, because the Shotscope system can measure and archive up to 50 process parameters (such as pressures, temperatures, times, etc.) for every shot monitored, the processing "fingerprint" for any part can be stored and retrieved at any time in the future. This functionality is extremely important to any manufacturers concerned with the potential failure of a molded part in its end-use application (for example, a medical device).

Shotscope maintains a reporting mechanism that communicates all the data collected and entered into the system across a manufacturing enterprise. As a result, informed decisions can be made. Users can generate production, scrap, downtime, efficiency, and job summary reports, any of which also can be used as documentation that accompanies part shipments.

Moldflow EZ-Track

Moldflow EZ-Track is software for real-time, plant-wide production monitoring and reporting. The EZ-Track system can be attached to virtually any cyclic manufacturing equipment and machinery, such as ultrasonic welders, assembly machines, packaging equipment, etc., in addition to injection molding machines. The EZ-Track system provides a scalable solution for production monitoring, which can be used by small, custom molders with fewer than 10 machines or by large, multi-national corporations with distributed injection molding and manufacturing operations around the world. There are extensive setup capabilities that allow complete definition of resources and flexible customization of most displays and reports.

The EZ-Track system collects data on cycle times, cycle/part counts, and number of rejects, and it uses this data as the foundation to perform powerful scheduling tasks. The EZ-Track scheduler can check for mold conflicts and machine feasibility and highlight any problems. The product continuously updates estimates of job completion times based on actual cycle time, downtime, rejects, and cavitation. In addition, the scheduler supports family molds.

EZ-Track monitors machine status, downtime, scrap, raw material usage, and labor activity. The product can also be used to track machine efficiencies and compute yield efficiencies. Labor, time, and attendance can be tracked by employee and associated with machines, jobs, and activities. In this way, manufacturing managers can determine what jobs, machines, or activities require more labor resources than others require. This capability can allow managers to investigate areas where more efficiency, possibly in the form of process automation, could be introduced into their manufacturing operations.

EZ-Track can be used to count good parts, diverted parts, packed cases, and other variables. Downtime is measured automatically and can be classified into an unlimited number of causes. Once production data is collected, there is an extensive set of Web-based reports that can incorporate trend charts, tabular reports, pie charts, and Pareto charts. It is possible to interface the EZ-Track system to ERP/MRP systems via an advanced SQL database that is open, fully documented, and ODBC-compliant.

There are many companies today across a broad range of industries for which plastic injection molding and related upstream and downstream manufacturing processes are on the critical path to achieving successful and profitable product launches. These companies face a variety of issues that make it difficult to remain competitive:

- ❑ Product life cycles are decreasing while short-term volume requirements are increasing exponentially.
- ❑ Customers continue to demand increased quality at lower costs.
- ❑ There is a shortage of skilled labor to run ever-more-sophisticated injection molding equipment.
- ❑ Inefficiencies in the scheduling, monitoring, and reporting of production do not allow for efficient manufacturing management.
- ❑ Molded part process documentation and traceability increasingly are becoming a standard requirement.

Competitive companies require tools that are intuitive, systematic, documentable, and globally supported, such as the Moldflow Manufacturing Solutions products, to remain globally successful.

For the latest information on Moldflow Manufacturing Solutions products, visit www.moldflow.com.

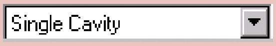
Using Moldflow Plastics Advisers 5.0

By Murali Anna-Reddy, Moldflow Corporation

Technique to model a direct sprue gate or hot sprue

For cylindrical or symmetrical shaped parts (boxes, cups, helmets, etc.) that are molded in single-cavity molds, a sprue gate is preferred. Here, the part is gated directly from the sprue. If the sprue is cold, then there is no gate and the sprue directly connects to the part. However, with a hot sprue a small gate is used to facilitate automatic degating. When modeling these types of gates, the key is to understand that Mold Adviser requires a sprue and a gate as the minimum for a feed system. Since there is no gate in the case of a cold sprue, you will need to model a portion of the sprue as gate entity. Say, for example, that your cold sprue is three inches long. Then, you could model 2.5 inch as Sprue and the remaining 0.5 inch as a Gate. Use the taper angle to calculate the starting and ending diameters of the Sprue and the Gate. Here is a step by step procedure to model these two gates.

1. Import the part model and set the model type to Single Cavity.



2. Orient the part such that the sprue is in the positive Z-axis. Next, select the injection location.

3. Select **Parting Plane** and position the parting plane a small distance above the injection point. The distance between the parting plane and the injection point will be the length of your gate.

4. Select **Specify Mold dimensions**. Set the 'A Plate' thickness to the length of the sprue.

5. Select **Edit Runner Defaults**. Set the dimensions of the sprue and gate.

6. Select **Sprue Location**. Click on the middle of the injection location, and click OK. This will create the sprue directly above the injection location

7. On the **Runner Generation** dialog, select **Generate Sprue and Gates**, and click OK.

This should complete the creation of the direct sprue gate or the hot sprue. Examples of each are shown below.

Sprue Gate (Cold Sprue)

Sprue Gate (Hot Sprue)

Technique to model a hot drop runner system

The process of modeling a hot drop runner system is outlined below using a simple example of a single-cavity mold. However, the same procedure can be applied to multi-cavity and family molds, as well as to modeling 3-plate cold runner systems.

1. Import part model and set the model type to Single Cavity.

2. Orient the part such that the sprue is in the positive Z-axis. Next, select the injection location.

3. Select **Parting Plane** and position the parting plane a small distance above the injection point. The distance between the parting plane and the injection point will be the length of your gate. Typically, with hot drops and 3-plate cold runner molds, a restricted gate called a Pin Point Gate is used for automatic degating purposes. The gate dimensions are typically very small compared to other types of gates.

continued on page 10

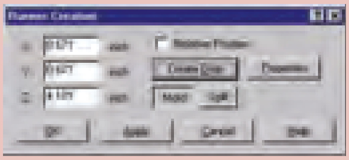
4. Select **Specify Mold dimensions**. Set the A Plate thickness to the length of the sprue. Turn on the Floating Plate, and set its thickness to the length of the hot drop.

5. Select **Edit Runner Defaults**. Set the dimensions of the sprue, runner and gate.

6. Select **Sprue Location**. Click on the middle of the injection location, and click OK. This will create the sprue directly above the injection location.

7. On the **Runner Generation** dialog, select **Generate Sprue**, and click OK.

8. **Select Design Runners**. This will allow you to create runners and gates manually. Click the bottom of the sprue. The **Runner Creation** dialog pops up. Select **Create Drop** and the hot drop will be created automatically using the dimensions specified earlier.

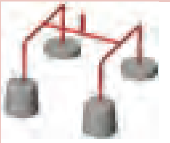


9. Only the gate is left to be created. Select **Display Beam Elements** to display the runner as a beam element. This is quite useful, especially if the runner is large and obstructs the view. Similarly, select **Display Cavities** to turn off the display of the cavities. This too can be helpful during the modeling of gates.

10. Now select **Design Runners** again and click on the end of the hot drop and then on the injection cone. The gate will be created automatically between the hot runner and the injection point.

This will complete the creation of a single-cavity mold with a hot runner system. An example of such a model is shown below. As mentioned earlier, the same procedure could be applied for creating hot runners for multi-cavity and family molds as well as 3-plate cold runner systems. Examples of such molds are shown below.

Single-cavity mold with a hot runner system



Family mold with a hot runner system

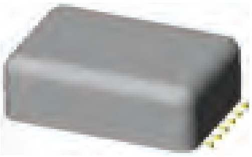
Single-cavity mold with a 3-plate cold runner system

Techniques to model fan, film, ring, or diaphram gates

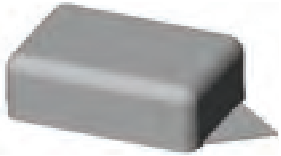
Using the geometry tools provided in the Moldflow Mold Adviser module, you can very easily model tunnel, cashew, and tab gates. However, when it comes to modeling fan, film, ring, and diaphram gates, the geometry modeling tools fall short. The limitations arise from being unable either to accurately represent the volume of plastic in the gate region or to accurately model the flow of the plastic from the gate into the cavity. The common aspect of all these types of gates is that the gates are very wide (sometimes extending the entire width or circumference of the part). The larger gate width spreads and slows the melt as it enters the cavity. If your object is to simulate only the effect of the gate on the plastic flow, you can do so by modeling several injection points along the edge where the gate connects to the part. In this case, you need not model the runners and gate, and the analysis would be done in the Part Only mode.

On the other hand, if you would like to design the entire sprue, runner, and gate system, then our suggestion is to model these types of gates in your CAD system. The STL file you would export from the CAD system should contain both the part and the gate geometry. The sprue and runners would later be added inside the Mold Adviser.

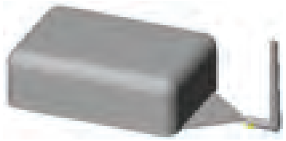
The example shown below features a part model with a fan gate. The two modeling scenarios explained above are shown in the accompanying images.



Several injection points used to represent plastic flow through the fan gate



Model with the part and fan gate designed in the CAD system



Sprue and runner added to the fan gate model to complete the runner system

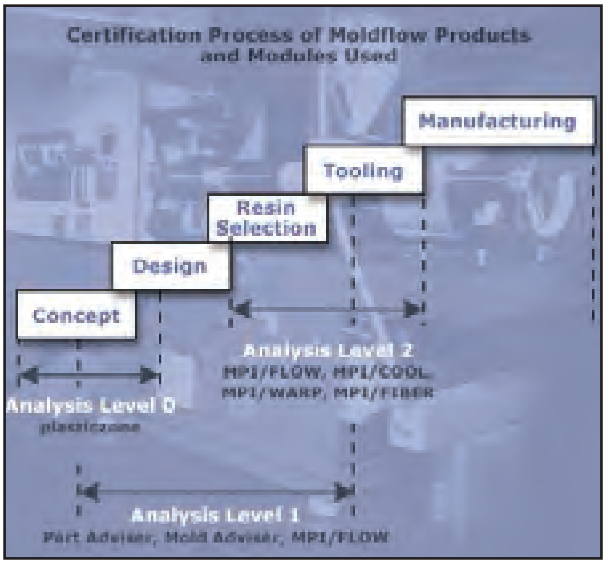
Enhancing Customer Education

By Stephen Thompson, Moldflow Corporation

Savvy software providers offer flexible, innovative training programs that help customers learn to quickly and efficiently become proficient using their software products. The initial challenge for organizations such as Moldflow is to develop effective methods of empowering customers with the skills, tools, and information to harness knowledge and maximize business performance.

The next challenge is to align these outcomes with business processes to deliver measurable results. Moldflow customers need to implement software and train users while adhering to existing time-to-market requirements and production deadlines. Sending engineers and designers off-site for week-long training sessions and on-the-job learning curves can negatively affect new product development cycles.

Knowing these challenges and as part of our commitment to help our customers achieve maximum business and productivity values as quickly as possible, Moldflow is launching the Moldflow Center for Professional Development (MCPD). The MCPD is a corporate university that is being developed specifically for our customers to empower MPI users.



The MCPD comprises a worldwide team of professionals who specialize in assessing, designing, developing, delivering, administering, and evaluating learning solutions to improve customer performance. These learning solutions will provide a blended mix of instructor-led classes; live, online collaborative learning experiences; and Web-based, self-study resources.

New course structure

We are developing an enhanced Moldflow curriculum that will include a five-day Simulation Fundamentals class designed to deliver instruction for our MPI/Flow module while introducing students to the basics of the Cool and Warp modules. The primary purpose is to "jump start" students so they are functional with basic performance requirements once back at work. As follow-up for students who wish to complete their Moldflow education, we recommend advanced training, which includes two-day classes focusing on the Flow and Cool modules, as well as a one-day Warp class.

With the release of MPI 3.0, a new, one-day update training class is being created for both MPI and former C-MOLD users. This class will be given for the first time at the International Moldflow User Group Conference in September and then offered regionally.

Our Web-based training initiative will allow students to have round-the-clock access to Web-based, self-study resources created by Moldflow. Web-based courses are planned to cover MPI 3.0 modules for gas-assisted flow, injection compression, co-injection, stress, and thermoset molding analyses, and these will augment the core MPI/Flow, Cool, and Warp classes. These Web-based courses are expected to be available in stages beginning in January 2002.

New certification program

In response to customer feedback, the MCPD will offer a corporate certification program. To become "Analysis Level 2 Certified," companies must:

- ❑ Implement the core MPI modules (Flow, Cool, Warp).
- ❑ Have Moldflow-trained users on staff who have completed the Simulation Fundamentals and advanced Flow, Cool and Warp classes and successfully completed the voluntary certification exam for each class.
- ❑ Have an active maintenance account.

Why get certified?

There are many benefits to becoming Moldflow-certified. With this investment in employee education, senior management will know that employees are using the current software correctly, thus justifying the cost of the software and the training. For companies that become certified, we will offer a special "Moldflow Certified" logo that may be framed for display or used for marketing purposes.

We will also include company information in our certification database, which will be available on our www.plasticszone.com Web site. This listing will reflect a company's formal knowledge, compliance, and experience with Moldflow products and processes. It will allow your company to use Moldflow proficiency as part of your sales process. The certification provides a standard by which your customers may objectively judge your Moldflow technical and functional expertise.

New simulation level definitions

In conjunction with our corporate certification program, Moldflow is launching new definitions for levels of simulation usage. Moldflow will offer formal certification only for Analysis Level 2. By promoting these definitions, we hope to create more value for our customers and to better differentiate our offerings.

For more information about Moldflow education and certification programs, please visit our Web site at www.plasticszone.com.

Avenue Mould Nears Decade as Moldflow Customer — Company Wins Top Honors as Toolmaker of the Year

By Laura Carrabine, Editor

Avenue Mould is Ireland's and the UK's leading mold-making company. The company specializes in manufacturing ultra-precise, multi-cavity, hot-runner, injection molds for the medical device, closure, and personal care industries. Its molds are designed for long service life with fully interchangeable cores and cavities.

Established in 1988 in Sligo, Ireland, Avenue Mould heralds a customer list of world class manufacturers including Abbott Laboratories, Bausch & Lomb, Braun Ireland, Becton Dickinson, Ferrero, Donegal Healthcare, Tyco Healthcare, United Closures & Packaging (UCP), Hewlett-Packard, Honeywell/AlliedSignal, Nypro, SIMS Portex, and Tech Group Ireland.

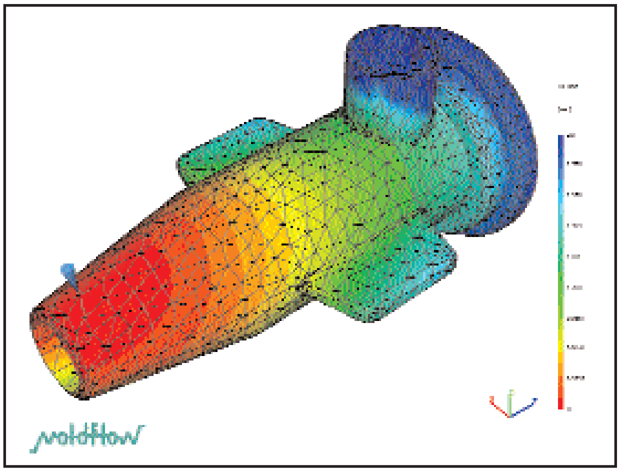
According to Avenue Mould Director Felim McNeela, "We have been using Moldflow software since 1992. We were the first Irish company to implement the technology to prove we are committed to using state-of-the-art products and techniques to develop our molds. As a result, we have retained top manufacturers and enjoy 98% return business from them. Product quality and customer satisfaction go hand-in-hand. Our goal is to exceed their expectations. Using our experience, Moldflow, and the best mold making equipment help us achieve that."

Due to the increasing complexity of product shapes, material properties, and the relentless drive for minimum cycle times, Avenue Mould uses Moldflow tools as an inherent part of the design process performing analyses on fill, cooling, pressure, and volumetric shrinkage.

Process flow path

Once Avenue Mould engineers obtain a mold design, they export the solid model as an STL file to initiate a Moldflow analysis. Typically, fill analyses are performed first to establish optimum gate locations. Temperature simulations are invaluable aids to design mold cooling circuits. The simulations also provide valuable information on areas that might be prone to short shots. Complex, thin-walled parts can be analyzed directly with minimal preparation. Hot runners can be incorporated at this stage. Using Moldflow, a variety of different materials can be tested in each simulation.

McNeela adds, "Moldflow helps us investigate how the plastic will flow in the mold prior to machining the mold. We use it as a technique to confirm with the customer that the plastic will flow reasonably well without too much stress and without air traps. Generally speaking, the models we work on are reasonably well designed without major problems. Using Moldflow provides customer peace of mind and satisfaction that the mold will work well once we manufacture it. The customer knows that the part design is acceptable and the mold will function effectively."



Moldflow as proactive tool

"The software is a confidence booster for both us and our customers," says McNeela. "If we didn't use Moldflow, Avenue Mould would out-source much of the work and lose revenue. We would also take a lot of shots in the dark practicing risky trial-and-error efforts," notes McNeela. "This business has enough risks without adding taking technical risks. Our work demands precision and quality. Using Moldflow assures us and our customers of both."

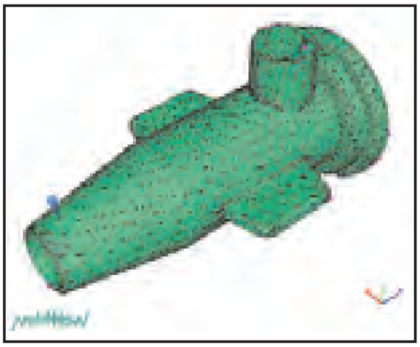
He and his team also use Moldflow for large projects in which proposals require analyses and results. The Moldflow simulation results are submitted as part of the complete quotation package.

Avenue Mould molds range in price from $75,000 to $200,000 and are intended for high volume, long term production — three to five years or longer. "Our customers invest a lot of money in their molds, and they expect them to work according to specifications. If a post-manufacturing problem occurs with the mold, it's going to compromise that customer's volume production and the life of the mold," adds McNeela. "Our customers are focused on mold quality for long term use. Using Moldflow is invaluable for achieving this objective."

Advanced testing center

Avenue Mould maintains a very advanced tool-testing center that adheres to clean-room standards. McNeela says, "Since we do a lot of work for the health care and medical device industries, a facility that meets their testing criteria is necessary."

MPX allows production professionals to take control by eliminating the usual trial-and-error method of injection molding machine setup and optimization and replacing it with systematic technology. Bringing the benefits of injection molding simulation



to the shop floor enables process engineers and molders to quickly optimize machine setup, reduce cycle times, and monitor and correct molding processes during production.

Some of the major benefits that Avenue Mould has found using MPX include the ability to:

- ❑ Optimize mold setups and shorten tool trials.
- ❑ Produce optimum processing conditions.
- ❑ Determine the size of the process tooling window to allow greater insight into minor adjustments.
- ❑ Complement results used with Moldflow Plastics Insight (MPI).
- ❑ Reduce cycle times.
- ❑ Scrutinize tools in production.

Toolmaker of the Year

Recently Avenue Mould won the Toolmaker of the Year award, a top honor sponsored by The Plastics Industry Awards and BASF plc. Avenue Mould won in three categories: Product Quality, Complete Project Support, and Investment in Design and Manufacturing. The Plastics Industry Awards, the industry's most prestigious honors, recognize and celebrate achievements in the UK plastics industry. Entrants are categorized as supplier, processor, product, or people. The awards offer insight into current development in material usage, product design, and innovative ways in which they are being manufactured.

For more information about Avenue Mould, visit www.avenuemould.com. Visit www.moldflow.com for more information about Moldflow and its products and services.

DO YOU HAVE A STORY TO TELL?

If so, we want to hear from you. To submit articles, case studies, or user reviews of any Moldflow technology, please contact Laura Carrabine at **laura_carrabine@moldflow.com** or call **+1 440 247 8653**.

Introducing Moldflow Plastics Insight 3.0

Moldflow Plastics Insight and C-MOLD 2000 Work in Synergy

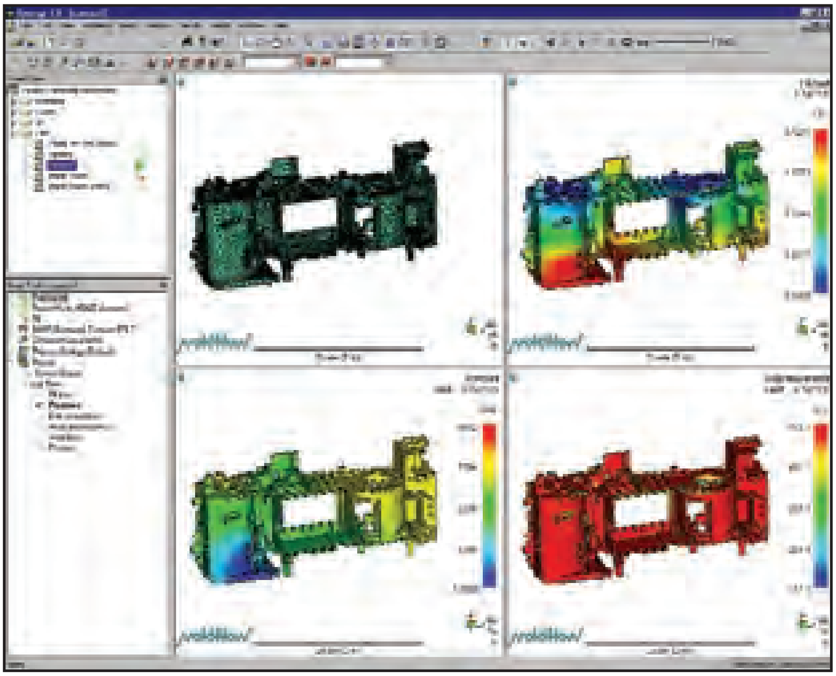
By Dean Piepiora, Moldflow Corporation

It's been touted as one of the biggest engineering undertakings in the CAE market in years. It's taken two of the most in-depth plastics analysis programs ever created and merged the best features into one product. It's Moldflow Plastics Insight™ version 3.0, the latest desktop analysis product release from Moldflow Corporation.

The Moldflow Plastics Insight (MPI™) and C-MOLD® 2000 suites of software are advanced injection molding software tools for predicting and eliminating potential manufacturing problems before they occur. When Moldflow Corporation and C-MOLD became one company in early 2000, one of the first goals set among the management and developers was to integrate the two existing advanced analysis products into one superset. Since that time, under the code name "Synergy," Moldflow development has moved ahead full force to create this integrated, advanced analysis product, which is being released as MPI version 3.0.

This product development effort has been accomplished on both technology and user-interface levels. In addition, many new features have been added to leverage the combined technical expertise of the Moldflow and C-MOLD product engineering teams. The result is a product much more powerful than the sum of the two — the definition of Synergy!

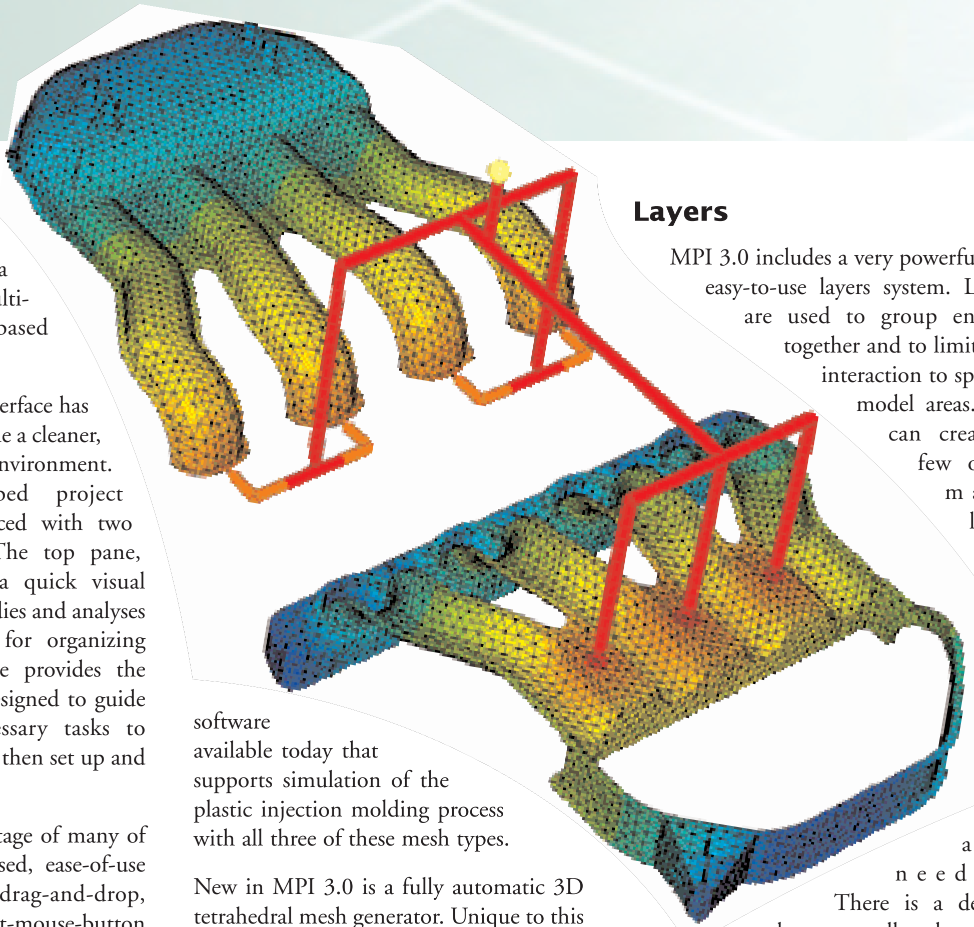
Many release goals and user enhancement requests drove the development of MPI 3.0. One major enhancement request was to improve the integration to leading



CAD packages to make it easier to get 3D solid CAD models into the Moldflow environment. Users also needed meshing and mesh editing tools to create a finite-element model that would be completely ready for analysis. To accomplish this, Moldflow developers created a new user interface to perform all pre- and post-processing functionality and eliminate the need for users to switch among multiple programs to complete their tasks. User requests also made it very important for us to put enhancements for MPI/Fusion and 3D analyses on the critical path. This combined development work also fostered improvements to the materials database and resulted in additional benefits to other analysis modules. A description of some of the major features and functionality enhancements follows.

New pre- and post-processor: MPI/Synergy

The MPI/Synergy module is a new pre- and post-processor used for model preparation, meshing, mesh editing, model validation, job setup, job control, results visualization and report generation. MPI/Synergy provides a new graphical user interface that supports all analysis modules of both the MPI and C-MOLD product lines. MPI/Synergy also supports



midplane, MPI/Fusion and 3D TET mesh models in a single multi-window, multi-document, Windows-based environment.

The MPI/Synergy user interface has been streamlined to provide a cleaner, more intuitive working environment. The previous six-tabbed project manager has been replaced with two dockable work panes. The top pane, Project View, provides a quick visual review of the different studies and analyses performed and is used for organizing projects. The lower pane provides the Study Tasks, which are designed to guide users through the necessary tasks to import their CAD model, then set up and run an analysis.

MPI/Synergy takes advantage of many of the popular Windows-based, ease-of-use functions, including drag-and-drop, double clicking, and right-mouse-button access for performing the most common tasks, and also includes many command shortcuts (control keys) that advanced users prefer to use.

Enhanced CAD Interfaces and Geometry Representation

The Moldflow Design Link (MDL) is completely integrated with MPI/Synergy. MDL provides data integration to leading CAD systems through standard interfaces such as IGES, STEP, and ParaSolid. New in MPI 3.0 is an option to directly import Pro/ENGINEER® part files. This works without the need to have a separate Pro/ENGINEER license.

In addition, imported geometry is now represented in MPI/Synergy as trimmed NURBS surfaces. These surfaces can be independently viewed, grouped, or meshed. NURBS surfaces are supported by the IGES, STEP, ParaSolid and Pro/ENGINEER file formats.

Meshing and Mesh Editing

MPI/Synergy provides a complete set of tools to create, edit and validate meshes for midplane, MPI/Fusion and full 3D analyses. Moldflow is the only CAE software available today that supports simulation of the plastic injection molding process with all three of these mesh types.

New in MPI 3.0 is a fully automatic 3D tetrahedral mesh generator. Unique to this feature is the ability to control the number of elements through the thickness of a part. This complements other automatic meshing capabilities already in the product for creating midplane and MPI/Fusion meshes.

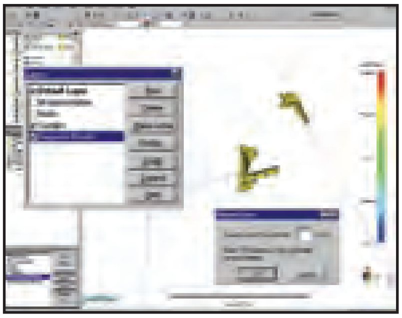
Also new in MPI 3.0 is a large set of meshing editing and validation tools. The new Mesh Diagnostics provide the ability to easily visualize the quality of the mesh in areas such as aspect ratio, overlapping elements, connectivity, thickness, free edges, and occurrence number. Several new mesh editing tools are provided to clean up and refine the mesh. Also, new selection methods are available to allow users to quickly and easily focus on specific problem areas.

In addition, MPI 3.0 also includes modeling wizards to automate the creation of multiple cavities, runner systems, cooling systems, and mold inserts. To learn more about mesh types and modeling tools, see "Exploring Moldflow Plastics Insight 3.0 Finite-Element Meshing Capabilities" on page 26.

Layers

MPI 3.0 includes a very powerful and easy-to-use layers system. Layers are used to group entities together and to limit user interaction to specific model areas. You can create a few or as many layers as needed. There is a default layer, as well as layers for specific model entities such as CAD geometry, nodes, and elements.

You can turn layers on and off to get a better view of the area of your model where you are focusing your interest. When a layer is turned off, features on it will not be selected. You can modify entity properties, such as element color or visualization style, layer by layer.



The use of layers is an integral part of efficient model preparation and mesh editing. When using the Mesh Diagnostics tools to display issues, such as high aspect ratio elements, you may select to have them placed on a new layer called Diagnostic Results. This allows you to turn off all other layers and visualize only the problem elements.

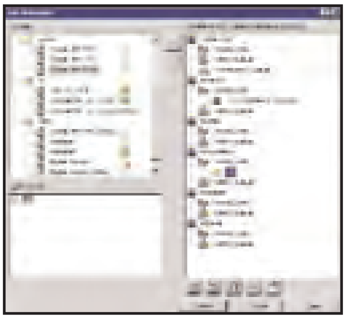
The new Expand Layer tool allows you to expand an area you have selected to include the next layer of connected elements, by one or more levels of connection. This allows you to edit problem elements easily, since you can visualize the connecting elements.

Results synchronization and window locking

MPI/Synergy includes a new Results Synchronization capability for comparing results. Typically, you would run an analysis, review the results, make some changes, and re-run the analysis. It is now possible to open the results from the new analysis and display them using the same scale as the results of the first analysis. This greatly helps in interpreting results and identifying the analysis that provides the better results.

Complementing Results Synchronization is a new Window Locking feature that allows any graphical windows to be locked together. Locking links view manipulation operations (pan, rotate, zoom, etc.) such that all window view changes are done simultaneously. This feature is useful during both the pre- and post-processing stages. During pre-processing, you can display your mesh in one window and the mesh Diagnostic Results in another to simplify mesh editing tasks. During post-processing, you can modify the view of different result quantities displayed in multiple windows at the same time to facilitate interpreting the results.

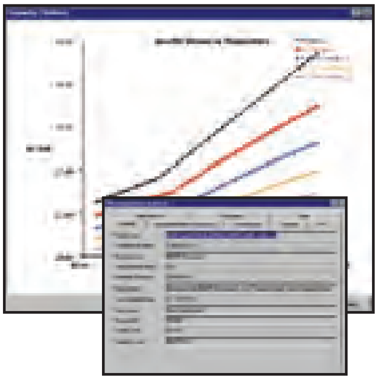
Job manager



The enhanced MPI 3.0 Job Manager allows you to submit jobs to available network job servers, without having to manually move any files to the machine actually running the analysis. Once the job is completed, you will be notified automatically. While the job is running, an interactive job status window allows you to view its progress. Another enhancement to the Job Manager is the distribution queue. This queue automatically distributes multiple analysis jobs from a design of experiments to available servers on the network. This functionality allows analyses to complete in as short a time as possible.

The improved Job Manager is designed to work with a heterogeneous hardware network as well. This means that all jobs can be distributed among Windows-based PCs and UNIX-based servers from either platform. For example, a user sitting at a PC could launch and monitor several jobs on any UNIX machines that had been specified as available job servers and vice-versa.

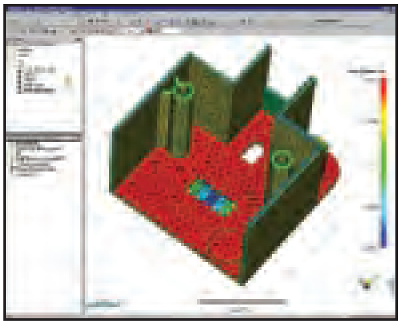
Expanded materials database



Similar to Moldflow Plastics Advisers version 5.0, MPI 3.0 provides the combined Moldflow and C-MOLD materials database. This includes over 7,500 unique materials and represents the most extensive material library available for plastic process simulation software. The database supports both Moldflow and C-MOLD material models, including the Moldflow second-order viscosity model, the Cross-WLF viscosity model, and the 2-domain, modified Tait pvT model.

For additional information, see "Moldflow Plastics Insight 3.0 Thermoplastic Material Properties Database" on page 22.

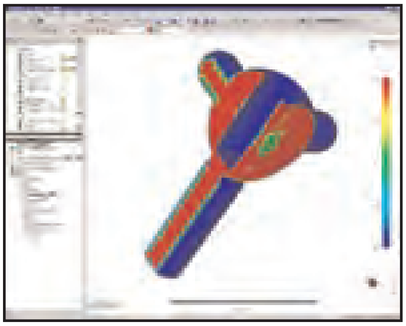
MPI/Fusion enhancements



Since MPI/Fusion was first released, the two most often requested enhancements have been the ability to display and change the thickness of the Fusion mesh. MPI 3.0 fulfills these requests and more. Now you can both visualize and modify Fusion model thickness directly within the user interface. This can be done on either a global or local basis. Mesh generation and editing capabilities are more complete, and more controls are provided to specify mesh density and to better visualize mesh quality. Mesh editing has been extended to better support local refinement, and tools are provided to re-match meshes between top and bottom surfaces. Additionally, the Fusion technology has been extended to support the MPI/Reactive Molding, MPI/Microchip Encapsulation, and MPI/Underfill Encapsulation analysis modules.

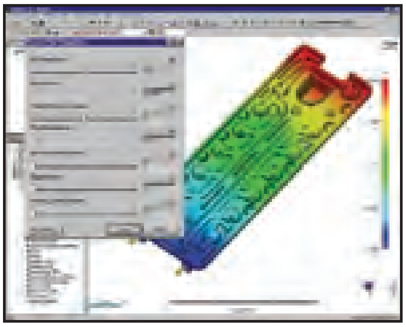
Having the ability to view and change the thickness of a Fusion model means you can assure that the model is as accurate as possible for running an analysis. It also makes it easy for you to modify the geometry, such as by adding flow leaders or flow restrictors to improve the part design.

3D enhancements



MPI/Flow3D now works with the MPI/Reactive Molding module to simulate thermoset injection molding, rubber injection molding, and thermoset transfer molding processes in full 3D. In addition, MPI/Flow3D has been enhanced to support compressible flow during the filling stage of the injection molding process, and now produces results for clamp force and shear-rate calculations for beams.

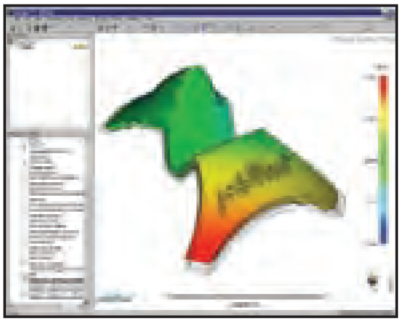
Design of experiments manager



The new Design of Experiments (DOE) solver is an exciting addition to MPI 3.0. This function automatically sets up and performs a sequence of analyses, varying the parameters that you specify. Once this is done, interpolated results displays are created automatically to provide quick and simple access to results data. Examples of input parameters include mold and melt temperatures, injection time, pack pressure, pack time, and part thickness. Output data include both single-point quality indicators such as volumetric shrinkage, injection pressure, clamp force, or flow front temperature, as well as interpolated displays of fill time, pressure, and temperature.

A DOE provides people with a reasonable arrangement of the experiments and statistically analyzes the results to finally optimize the processing parameters and the end product. The DOE analysis requires multiple analyses to run, depending on the number of factors you want to investigate. For this reason, the DOE is closely integrated with the distribution queue within the MPI 3.0 Job Manager to distribute the analyses automatically to available machines listed on the server.

Analysis enhancements



In MPI 3.0, we have integrated many of the modules from the MPI and C-MOLD products into a single, merged simulation solution set. For example, C-MOLD users now can access the optional MPI/Fusion (Cool, Fiber, Optim and Warp), MPI/3D (Flow and Cool), MPI/Stress, and MPI/Optim modules, as well as expanded capabilities in the MPI/Warp and MPI/Cool modules. Moldflow users can access the optional Injection Compression and Co-injection analysis modules, as well as extended capabilities in the MPI/Microchip Encapsulation and MPI/Gas modules. All analysis modules are available directly through the new MPI/Synergy graphical user interface.

An added enhancement for MPI/Gas users is the new ability to simulate fiber-filled gas-assisted injection molded parts through to warpage predictions. This provides the means to understand the affect of the gas on the final part shape and allows you to study changes to the design of the gas channels and their effects on the part.

Finally, in all modules there are no longer any programmed limits to the number of nodes and elements that can be used in an analysis. As part models, especially multi-cavity models, increase in physical size, the number of elements required to represent them also increases. Removing these limits benefits those who have to simulate very large models.

Conclusion

There are many companies today across a broad range of industries for which plastic injection molding and related upstream and downstream manufacturing processes are on the critical path to achieving successful and profitable product launches. MPI 3.0 has been specifically developed to meet those needs, integrate numerous user enhancement requests, and take the best functionality from both MPI and C-MOLD products and merge them into one.

While this article introduces many of the highlights of MPI 3.0, it does not provide a complete list of all the new features and enhancements that have been included in the product. For the latest information on Moldflow Plastics Insight and all of Moldflow's products and services, visit our Web site at www.moldflow.com.

Energy savings: a new revenue source for molders

By Barr Klaus, Vice President, Technology, Milacron, Inc.

"Energy crisis" seems to wax and wane as a news headline, but anyone with more than a few years of business experience can see the long-term trend for energy costs is — and will continue to be — up, not down. For injection molders under pressure for cost reductions or "rebates" on past work, the recent California crisis helped bring into focus the painful reality that energy is one of the top three or four cost components of a molded part, and hydraulically powered molding machines consume about three times more energy than all-electric injection machines. It's now clear the more efficient electric machine can put that operating cost difference right back on the molder's bottom line.

All this has been proven by independent tests, but few molders have considered the large-scale impact for the nation and their own businesses. Milacron estimates all-electric injection molding machines could annually cut 8.9 million megawatt hours of electricity from the process on a national basis — 700,000 megawatt hours and $42 million annually in California alone.

Large companies realize there's a lot of energy money being left on the table, not just in molding, but throughout the enterprise. Many have mandated across-the-board energy reductions in their operations because they realize energy cost savings go straight to the bottom line. At three times the efficiency of conventional machines, new-generation, all-electric injection molding technology figures heavily in many programs. So to make electric molding more accessible and affordable for the industry, Milacron has opened the world's first Energy Resource Center for plastics injection molding.

The center addresses the interests of top corporate management, mold makers, financial executives, facility designers, utilities and energy aggregators/brokers, as well as molding managers.

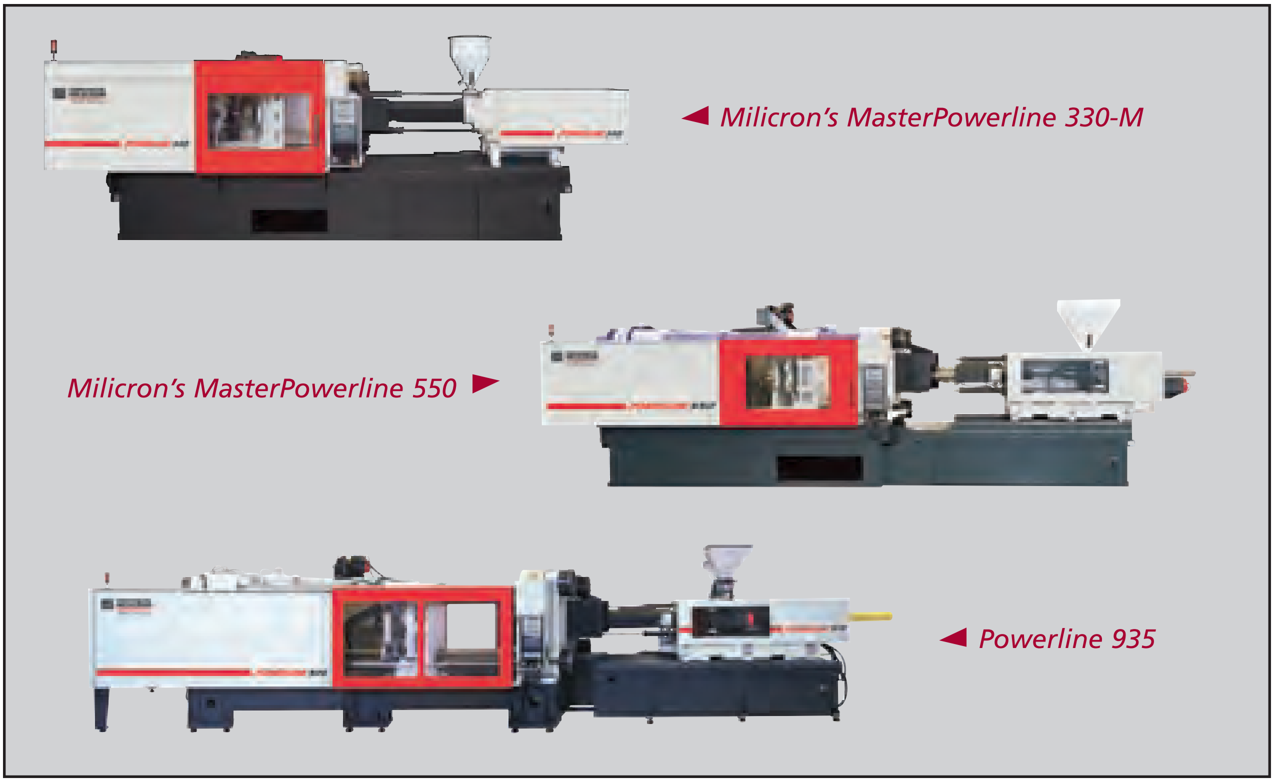
We are teaming up with energy service companies who can package all-electric molding technology as part of a long-term operational cost solution that makes sense in the boardroom. This offers the industry a unique advantage for rapid integration and justification of all-electric molding for green-field plants.

The Energy Resource Center will assist in benchmarking an existing process against all-electric injection molding, with comparison of a wide range of cost and productivity factors. We're already working with energy service companies to give them the benchmark data they need to make sound financial decisions in helping their own customers design energy-efficient facilities or processes. For customers who need more data or assistance, the Energy Resource Center will run production lots of product or provide fee-based design services for re-configuring a plant for higher efficiency or creating a new plant on a clean sheet of paper.

All-electric injection molding machines were once considered "special purpose," but they've established themselves as the new standard in cost-effectiveness for any application. While they continue to increase market share in precision molding, they are more often used for ordinary products from automotive parts and cutlery to pet-food dishes and soft drink cases. In short, all-electric injection presses have turned a technology corner and are now measurably better than hydraulic or hybrid machines for mainstream applications.

The four independently powered and controlled axes of electric injection molding machines overlap the functions of clamp, injection, extrusion, and ejection, giving a molder lots of ways to shave cycle time. And the direct, mechanical connections between motor and machine components mean drift-free, precision positioning for the clamp, screw, ejectors, and injection unit — nothing can move in any direction without a command from the control. Thus, pre-injection and coining are standard capabilities on most electric machines.

In fact, all-electric presses outperform hydraulic and hybrid machines in a number of key areas, even high-speed packaging applications. It's a real eye-opener for a packaging tool-maker to see an electric machine run stack molds and inject at 100+ in^3/sec. At NPE 2000, a 550 ton electric machine molded 5-gallon buckets with an injection unit capable of 600+ lb/hr throughput, speeds of 521 mm/sec, and pressure to 27,500 psi. And the "speed record" for injection belongs to a newly developed electric machine with linear motors on the injection axis: 2000 mm/sec for "paper-thin" molding.



This new breed of electric machine is no longer a limiting factor on cycle time. It's not uncommon for an all-electric machine to "outrun" a mold that was already taxing the limits of a high-performance, accumulator-boosted hydraulic machine, which shifts the focus of the process design quite a bit.

Mold design can be simpler and less expensive for an all-electric machine as well, because independent operation of clamp and injection allows parting-line venting during tonnage build. This reduces cost and time for excessive or difficult mold vents. Venting during pre-injection means there's less resistance in the mold; fill times are shorter. Hot gas that can overheat the mold or melt is relieved. And mold maintenance is reduced because plasticizer does not build up so quickly in the vents.

Precise control of mold position also reduces wear, especially for stack molds, allowing more design freedom and lower cost. Higher cavitation or larger parts can often be accommodated in the same clamp area, too, because the precision shot control on an electric machine typically reduces clamp force requirements.

Electric injection molding machines continue steady market penetration in the USA (30+%) and Japan (70+%) as energy costs rise and cost gaps between electrics and hydraulics decline. The only disadvantage of electric technology is that, ton for ton, ounce for ounce, the equipment has a higher initial cost. Despite an initial cost premium, electric injection molding machines cost so much less to operate that real savings accrue from the very first part molded on the machine, rapidly offsetting the difference.

Can the "more expensive" machine actually cost less to own long term? The market has already decided that it does.

1. There's no warm-up, no delay in waiting to find out what quality of part will be produced on the machine that day. Output is usually stable and predictable after the first 3-4 parts, as well as after 4-5 years.

2. Material use can be lowered, close to the threshold of a short shot, without exceeding that threshold.

3. There's no expense for cleaning, storage, disposal, or maintenance of hydraulic fluid.

4. Air conditioning load on the plant is greatly reduced.

5. Low noise levels (<68 dBA) allow more flexibility in plant layout, siting other functions or facilities near molding machines.

6. For new construction, electrical service to the plant can be reduced about two-thirds, tower water requirements reduced, and plumbing reduced.

7. Faster cycles are achieved due to the inherent ability to overlap functions.

Moldflow Plastics Insight 3.0 Thermoplastic Material Properties Database

By Robert Newman, Moldflow Corporation

Introduction

Moldflow Corporation's predictive analysis products, Moldflow Plastics Insight (MPI) and Moldflow Plastics Advisers (MPA), are used to simulate the complex behavior of injection-molded polymer melts. As Moldflow is constantly striving to assure that our analysis results are as accurate as possible, one of our highest priorities is to provide analysis solver algorithms and material data to achieve that goal. Regarding material data, Moldflow has developed some of the world's most innovative testing methods to assure that the material characteristics used for analysis represent those of injection-molded polymer melts. For example, Moldflow uses instrumented injection molding machines to determine rheological data, which is basic to all flow analyses.

This article covers the thermoplastic material properties required for Moldflow analysis, the test methods used to derive the data, and some of the unique features which contribute to making the Moldflow Material Database the most comprehensive of its kind in the world. We follow internationally recognized standard test methods as well as fully documented, internal standard methods, which have allowed us to achieve significant simulation improvements. We provide a large database on as wide a range of polymer materials as possible, including data obtained from resin manufacturers and third-party sources. Also introduced are the key features and enhancements of the Moldflow Plastics Insight 3.0 (MPI 3.0) Material Database.

Viscosity test methods

Moldflow's injection molding simulation software is used to predict the flow of polymer melts through mold sprues, runners, gates, and part cavities. As such, the most accurate analyses that can be performed start with the most accurate material rheological data. Moldflow studies have clearly shown that rheological characteristics measured on instrumented injection molding machines can yield better simulation results for both filled and unfilled materials. Therefore, Moldflow's standard and recommended test method employs instrumented injection molding machine rheometers.

However, standard capillary rheology data is widely available and it may be the only data available to many of our users. Other testing techniques are also applied at times due to unique material behavior or limited access to preferred techniques. Moldflow will continue to provide such data upon request, and will offer such data within our standard databases.

A major drawback of having such a variety of testing techniques is that Moldflow users were previously unaware of which testing technique was used for each data set. Therefore, a new feature of the MPI 3.0 Material Database is that each data set within a given material grade now includes test method information, including the source, date of testing, and test method used, if the information is available.

Viscosity data models

In order to provide a more consistent database, the Cross/WLF model has been applied as the default model to the materials in Moldflow's database. The Moldflow second-order model is still available and will be provided for many materials.

Viscosity indexes

Users have expressed a desire to have a simple, single-point comparison of viscosity for different grades. While such values do not show the relevant effects of shear and temperature upon viscosity, they often can be useful for comparing very similar materials. Melt Flow Rate (MFR) values are listed in the Moldflow Material Database when available. To avoid any confusion in comparisons, only complete MFR data sets, with appropriate test temperature and plunger mass details, are listed.

However, it is important to note that there are some limitations to MFR data: it is not available for all materials, and it is a measurement performed at fairly low shear rates relative to those that occur during injection molding. To address these issues, the Moldflow Material Database lists a Moldflow Viscosity Index value. This single-point viscosity value is generated from a material's actual viscosity model at a typical melt processing temperature and a shear rate of 1000 1/sec. To further aid in the ease of comparing materials of the same generic type, the Moldflow Material Database now has Moldflow Viscosity Index values generated at the same temperature. This makes it very easy to search the database to identify materials of the same generic type with similar Moldflow Viscosity Index values.

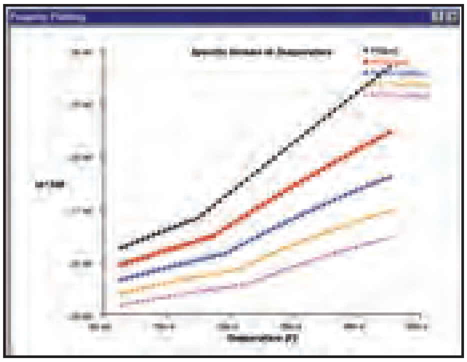
Transition temperature data

A single-point transition temperature is used to define the material's state transition from melt to solid. This data is commonly measured by a differential scanning calorimeter in a cooling mode. However, various methods may be used by different data sources. The MPI 3.0 Material Database now provides the method used to measure or estimate the transition temperature, if the information is available.

Thermal conductivity and specific heat data

The thermal properties of polymers change with temperature. In order to improve the accuracy of simulation, the ability to store and use temperature-dependent thermal data is required. A new feature of MPI 3.0 is that tabulated thermal conductivity and specific heat data as a function of temperature can be used for simulations. Such data is available for over 2,000 grades. Because thermal properties data may be generated by a variety of test methods, the MPI 3.0 Material Database now provides the test method used, if the information is available.

Pressure-volume-temperature data



The effect of temperature and pressure on material density is an important property for simulations. Data can be gathered by either indirect or direct dilatometry techniques.

pvT data model

The two-domain, modified Tait model currently is used for all data in MPI 3.0. In order to assure consistency within a data set, all single-point density values are derived from the pvT model in use. The MPI 3.0 Material Database now provides the source of pvT data, date of testing, and test method used, if the information is available.

Shrinkage data

MPI 3.0 allows the use of three types of shrinkage data and models:

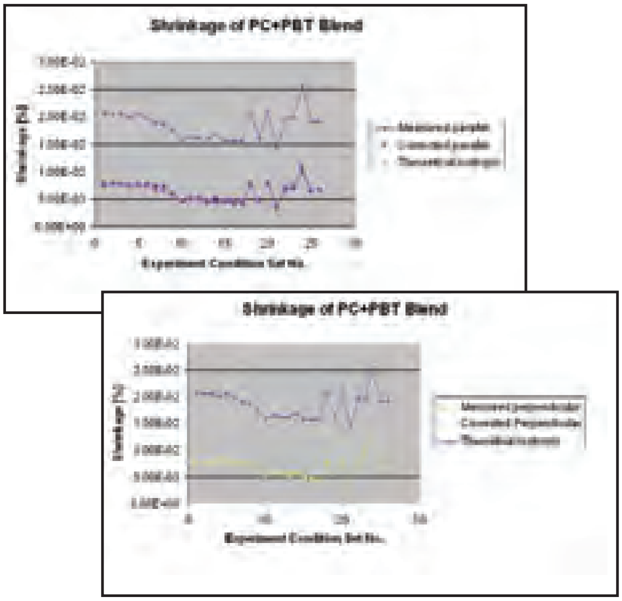
1. Residual Stress model (mechanical properties data required).

2. Residual Strain model (Moldflow shrinkage data required).

3. Corrected In-Mold Residual Stress (CRIMS) model. (Moldflow shrinkage data required).

Moldflow strongly recommends using the CRIMS model to achive the best simulation results. The CRIMS technique uses the predicted residual in-mold stress from the theoretical model and corrects it to achieve unprecedented accuracy in the prediction of shrinkage and warpage. The result is anisotropic residual stress distributions that account for morphology and structure in both amorphous and semi-crystalline materials.

The CRIMS method combines a theoretical model for residual stress, a model for morphology development, and correction of errors due to the use of material data that are obtained under laboratory conditions rather than those experienced by the material in injection molding. Because CRIMS data must be correlated with the remaining data set and to the software build, the MPI build number has been added to the data set.



Conclusion

Accurate material properties data is critical to assure the accuracy of your analysis predictions. For this reason, Moldflow spends considerable development resources to maintain and update the Material Database, as well as to develop and improve test methodology.

The Moldflow Material Database for MPI 3.0 includes data on over 7,500 resins and the following enhancements:

- Additional information regarding data source, last modified date, and test method will be provided if it is available.
- Viscosity index data has been improved by listing MFR data only when complete with test conditions and by improving the consistency of Moldflow Viscosity Index data within generic families.
- The Cross/WLF viscosity model is applied universally throughout the database.
- Multi-point specific heat and thermal conductivity data as a function of temperature now can be stored.
- pvT data is fit to the two-domain, modified Tait Model.
- CRIMS data is provide with a build ID number to assure appropriate data is used with MPI releases.

For information on the MPI 3.0 Material Database, Moldflow's injection molding rheology, or CRIMS shrinkage modeling, contact Moldflow Plastics Labs at: mpl@moldflow.com.

Plastics Engineering Education at the University of Massachusetts Lowell: the Past, the Present, and the Future

By Robert Malloy, Professor of Plastics Engineering, UMass Lowell

The past

The Plastics Engineering Program at the University of Massachusetts Lowell has a very strong history as a leader in the field of plastics education. The school, first known as the Lowell Textile School, was founded in 1895 to serve the needs of the local textile companies. Over time, the textile industry gradually started moving away from the Lowell area to the southern states, and the focus of the school shifted to other newly emerging technical areas. In 1954, the name of the school was changed to Lowell Technological Institute to reflect this broader educational mission, the very same year that the plastics program was founded. There were only eight students in the 1958 first graduating class who received Bachelor of Science degrees in Plastics Technology. As time went on, student interest in this novel plastics program grew rapidly, due in large part to the great demand and good job opportunities for well-trained plastics technologists. The word spread quickly, and subsequent classes included as many as 100 graduates.

In these early years, three dedicated faculty members molded the program's curriculum and laboratory facilities. There is no question that Lowell's plastics program would not be where it is today without the efforts of these three professors, especially the late Russell W. Ehlers. Russ was responsible for bringing the strong, hands-on processing focus to the plastics department, which still exists today. Russ also served as department chair for many years. The late Raymond Normandin was responsible for developing the chemistry and materials aspects of the program. His influence can be still be felt today as approximately 25% of the current curriculum credits are chemistry and plastics materials courses. The third founder, the late Henry Thomas, was responsible for bringing the solid engineering and design focus to the department. Once again, this remains as an integral part of the program.

Professor and plastics department founder, the late Russell W. Ehlers instructs student Keith Orrell during an injection-molding laboratory experiment (circa 1975).

In fact, this balanced curriculum is what continues to make the now Accrediting Board for Engineering and Technology (ABET) Plastics Engineering program at the University of Massachusetts Lowell so unique. Students enrolled in the Plastics Engineering program receive an education that is a well-rounded balance of engineering and design fundamentals, hands-on processing and testing experience, and a strong plastics materials background. The B.S. program has always been the backbone of the Plastics Engineering Department, and the department has maintained its ABET Plastics Engineering accreditation since 1977. In more recent years, the department also developed a strong set of graduate programs and a research focus. The department has offered an M.S. degree in Plastics Engineering since 1968, a joint Polymer Science/Plastics Engineering Ph.D. degree since 1981, and a Doctor of Engineering degree since 1986.

The present

Students hard at work in the new Moldflow Process Simulation Laboratory at the University of Massachusetts Lowell.

The Plastics Engineering Department at UMass Lowell has grown to the point where it now has sixteen full-time faculty and 30,000 square feet of laboratory space. The Plastics Engineering faculty strive to maintain a balance of the theoretical and hands-on aspects of plastics engineering education that was set forth by the department founders. As of this year, more than 3,000 students have received undergraduate or graduate degrees in plastics. The department attracts both men and women, and this year's junior class has an equal number of male and female students.

There have been some major changes and improvements to the program over the years. The theoretical aspects of engineering education, such as the laws of thermodynamics or condensation polymerization reaction kinetics, are the same today as they were 47 years ago when the program started. However, the technologies used to design, manufacture, and test plastic products have changed dramatically over the past 45 years. One of the most significant challenges that any hands-on plastics technology or plastics engineering program faces is keeping the laboratory facilities and equipment up to date. This has been a perpetual problem for the department in the past, but things are changing in a very positive way, and rapidly.

The faculty at UMass Lowell, especially Professor Steve Orroth '66, have worked extremely hard to keep the plastics processing, design, and testing laboratories as up to date as possible. However, this can be an extremely expensive proposition. Each year the department receives an equipment budget, usually just enough money to purchase one major piece of plastics processing or testing equipment. For instance, one year the department would purchase a new twin screw extruder, and the next, an injection molding machine. Later, they purchased a capillary rheometer, and so on. Using this model, the turnaround time for new plastics processing or testing equipment (for any given process or test) could take as long as 20 years.

Recently, the department developed a new model for keeping both the laboratory facilities and equipment as close to the state of the art as possible. Working with UMass Lowell's Office of Development, the Plastics Engineering Department has developed a five-year master plan for laboratory facilities renovation and equipment upgrades. The plan was implemented in 2000 and is ongoing. The 30,000 square foot laboratory facility has been divided into 10 separate laboratories, each dedicated to a very specific lab activity. There are injection molding, extrusion, and computer simulation laboratories. The new concept is to "partner" with the leading corporations that excel in each of these 10 specific technology areas to jointly create new, state-of-the-art lab facilities.

The first laboratory to be completed was the Milacron Injection Molding Laboratory. Ferromatik Milacron has installed three injection molding machines in the laboratory. The facility houses a conventional Vista toggle molding machine, an all-electric Electra molding machine, and a Prowler tie-bar-free molding machine. For its part, the university provided the funds for renovating the facility to accommodate the equipment. The facility renovations were extensive and included new utilities, overhead cranes, lighting, air conditioning, safety equipment and cosmetics. The end result is an up-to-date teaching facility that is made possible by the generosity of Ferromatik Milacron. The company also maintains the molding machines and plans to upgrade the equipment as new technologies are developed. The students are thrilled to have the opportunity to work with the latest injection molding equipment. In fact, a number of students conduct research projects that directly benefit Milacron to close the partnership loop.

The second laboratory was completed about one year ago and was sponsored by Moldflow. It is known as the Moldflow Process Simulation Laboratory. Moldflow provided more than $1 million in support of this newly constructed, 16-seat computer-aided design center. This modern facility gives students access to the latest in plastics process simulation software, including Moldflow's MPA, MPI, and MPX software products. The laboratory is widely used by students enrolled in mold design, die design, and part design classes. As with the other labs, Moldflow will provide software and technology upgrades as they are developed.

The most recent laboratory renovation project to be completed is the Battenfeld Gloucester Film Extrusion Laboratory. Battenfeld Gloucester is a leading manufacturer of film extrusion equipment. The company recently donated a complete blown film extrusion line, custom built to the specifications of the Plastics Engineering Department. The installation value is more than $300,000. Once again, the university provided funds for a complete facility renovation. The end result is a laboratory that is a dramatic improvement over the previous 1970s-vintage film extrusion line.

These are just three examples of the ongoing lab renovation efforts. Other corporate lab sponsors include Spirex Corporation and Freudenberg-NOK. This new model for keeping UMass Lowell's plastics laboratories up to date is working well, thanks to the combined efforts of the UMass Lowell administration, the Plastics Engineering Department's faculty, and corporate partners.

The future

Today, the Plastics Engineering Department at UMass Lowell has some energetic and ambitious plans for the future to better train the "next generation" plastics engineers. Predicting the future requirements of the plastics industry is difficult, so the department depends upon the advice and guidance of an Industrial Advisory Board, chaired by Nick Fountas '75 of JLI - Boston. This diverse group of 30 engineers and managers keeps the faculty abreast of industry trends and future needs. Some of the major initiatives that will take place over the next few years are described below.

UMass Lowell is known for its expertise in the area of plastics engineering, but is beginning to work more with thermoplastic and thermosetting elastomers as demand for these materials increases. Several faculty members, including professors Ross Stacer and Joey Mead, specialize in the elastomer field and have partnered with Freudenberg-NOK to create the Freudenberg-NOK Elastomeric Materials Laboratory. The laboratory, scheduled to open later this year, will have equipment for compounding, processing, design, and testing of elastomeric materials.

The environmental aspects of plastics education are becoming more important on a daily basis. The department conducts a great deal of research in the area of biodegradable plastics and plastics recycling. Student interest in these areas is so significant that, over the next two years, the department will construct and equip a standalone laboratory that is dedicated to plastics recycling research.

UMass Lowell has established itself as a leader in "distance learning." The Plastics Engineering Department has partnered with Nypro Institute, which currently offers a number of online classes. While the faculty prefer to teach in person, the demand for remote-based education is very real, and the department's activities in this area are likely to ramp up as these technologies evolve.

The faculty are here to serve the needs of industry, and your input regarding future plastics industry trends is valuable to us. Please feel free to contact us regarding educational program information, research capabilities, or partnership information.

Exploring Moldflow Plastics Insight 3.0 Finite-Element Meshing Capabilities

By Dean Piepiora, Moldflow Corporation

The enhanced user interface available in Moldflow Plastic Insight (MPI) version 3.0 now provides significantly improved finite-element mesh creation, diagnostic, and editing tools that allow organizations to speed products to market faster at more economic costs. It's now easier than ever to create the right mesh for the analysis you want to perform, whether you start from scratch or with a CAD solid model. You'll also find new wizards to streamline cavity duplication, runner creation, and cooling circuit creation in the MPI environment.

Midplane mesh

The midplane mesh, or thin shell mesh, is the basic model format required for traditional MPI analyses of thermoplastic and thermoset molding processes. A midplane mesh represents a solid model of a thin-wall part with triangular elements that are formed by three co-planar nodes and have thickness values assigned to add the third dimension. In MPI 3.0, you can create a midplane mesh by creating the surfaces and regions manually. Moldflow also offers the optional Midplane Generator, which automatically classifies and matches the corresponding elements and collapses them to a midplane mesh, complete with the appropriate thickness assigned.

MPI/Fusion mesh

The MPI/Fusion mesh is based on Moldflow's patented dual-domain technology and represents a solid model of a thin-wall part with midplane mesh elements and surface (double-skin) shell elements. A MPI/Fusion mesh more closely matches the exact shape of the 3D model and is much faster and easier to create than a midplane mesh.

A MPI/Fusion mesh is created automatically when you mesh a solid model in MPI 3.0. New in this release is the ability to visualize and modify the thickness of a MPI/Fusion mesh. Mesh editing has been extended to better support local refinement, and tools are provided to re-match meshes between top and bottom surfaces. A MPI/Fusion mesh can be used for MPI/Flow, Cool, Warp, Shrink, Fiber, and Optim analyses, and new in MPI 3.0, for Reactive Molding and Microchip Encapsulation analyses as well.

3D TET Mesh

For thick and chunky parts, true 3D analysis is required to simulate the molding process accurately. A 3D TET mesh represents a solid model with tetrahedral, solid volume elements. The 3D TET mesh provides the most accurate representation of the actual part geometry. A 3D TET mesh is required for MPI/Flow3D and Cool3D analyses, and new in MPI 3.0, the Reactive Molding module also accepts a 3D TET mesh. Also new in MPI 3.0 is an automatic tetrahedral mesh generator used to create 3D TET meshes automatically from your CAD solid model.

Expanded Analysis Capabilities Take Advantage of Enhanced Meshing Capabilities in MPI 3.0

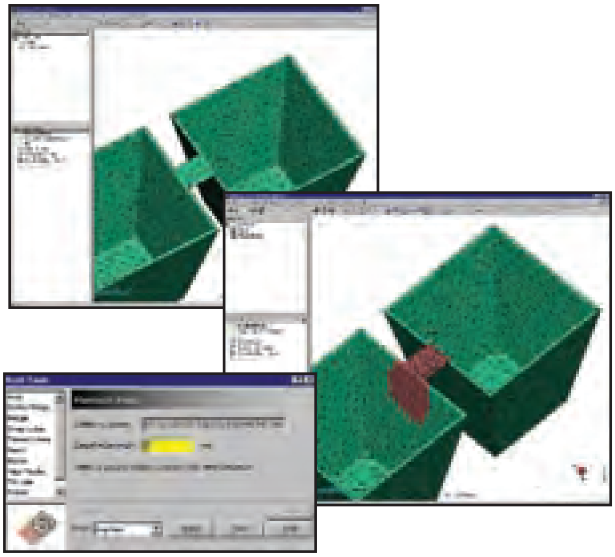
Mesh Model Formats			MPI 3.0 Analysis Modules	
Midplane	Fusion	3D TET		
X	X	X	MPI/Flow	Thermoplastic Molding Processes
X	X	X	MPI/Cool	
X	X		MPI/Warp	
X			MPI/Stress	
X	X		MPI/Fiber	
X	X		MPI/Optim	
X			MPI/Gas	
X			MPI/Co-Injection	
X			MPI/Injection Compression	Thermoset Molding Processes
X	X	X	MPI/Reactive Molding	
X	X		MPI/Microchip Encapsulation	
X	X		MPI/Underfill Encapsulation (Flip-Chip)	

More Analysis Options for Mesh Types

Mesh diagnostics and editing tools

No matter which type of mesh you use, depending on the complexity of the initial geometry, you may have to edit the mesh to clean it up before it is ready for analysis. Use the comprehensive Mesh Statistics report to assess mesh quality. The Mesh Statistics report tells you the number of nodes and elements, as well as the types of elements, included in your model. It also identifies mesh quality problems, such as elements that overlap, have high aspect ratio, or are not oriented correctly.

Your next step is to use the Mesh Diagnostics tools to highlight specific areas where you need to focus your mesh editing tasks. MPI 3.0 provides a number of powerful mesh editing tools for performing operations such as merging, inserting, and moving nodes automatically or manually. MPI 3.0 also provides enhanced remeshing capabilities that function on a local or global level, allowing you to control the density of the mesh generated on your model. This is particularly important in areas of your model where you need a much finer mesh for improved simulation accuracy, such as on a living hinge.



Enhanced remeshing capabilities let you control the mesh density on a local or global level, you can improve simulation accuracy by specifying a finer mesh to better capture information in critical areas of your model.

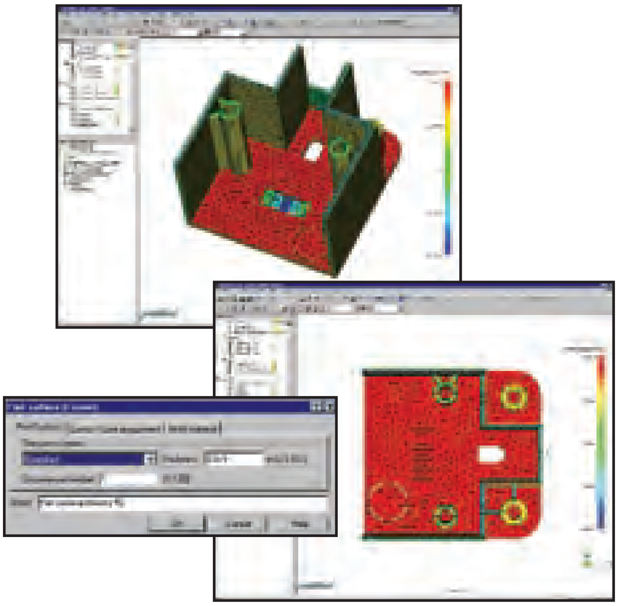
Many of the mesh diagnostics results can be presented either as a Text Output, which opens a new window with a description or list, or as a Display, which is highlighted directly on your mesh model as a shaded plot. As you edit your mesh, the diagnostics display will update actively, so you can see when you have corrected each problem area. You can choose to place the diagnostic display in a diagnostics layer, which will allow you to turn off the rest of your mesh and make it much easier to edit the elements that need to be addressed.

New wizards streamline modeling tasks

Use the Cavity Duplication Wizard to create a multi-cavity layout and position the cavities before you create a runner system. You can position the cavities automatically so that the gates are in line, then use the Runner Wizard to connect all the cavities, or model the runner system manually.

Use the Runner Wizard to create and lay out a runner system automatically, complete with sprue, runners, and gates. You can specify the sprue position and choose hot or cold runners; specify the dimensions of the sprue and runners, as well as of the drops if you chose hot runners; and specify the dimensions of the gates.

Use the Circuit Wizard to create and lay out a simple mold cooling system automatically. Use these cooling circuits to run a Cooling analysis immediately, or as the basis for a more complex cooling system that you add manually.

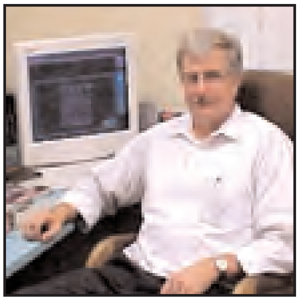


Use the new mesh diagnostics and editing tools to change the thickness of a MPI/Fusion model directly in the MPI 3.0 environment. The diagnostic display is updated automatically to give you a visual cue that the change has been made.

To get detailed information about the new modeling and meshing capabilities in MPI 3.0 and all of Moldflow's design optimization solutions and services, visit www.moldflow.com.

Changing Times for Mold Designers: Technology Leads the Way

By Scott Peters, Sales/Engineering Manager, ProMold, Inc.



I am uniquely positioned in our industry to comment on the ever-changing culture of the mold making industry. I began my career in this business as an apprentice mold maker/designer, and later as a manufacturing engineer. Today, I am a sales/engineering manager and have been fortunate to see first-hand the kinds of changes we are experiencing today.

For years, in some companies, mold designers were considered overpaid draftspeople. Many toolmakers and product engineers envisioned these individuals as a means to obtaining a functional injection mold. However, these overpaid draftspeople were only needed when it came time to determine parting lines and general mold construction methods. The actual completed design was left to the artisan toolmaker. The toolmaker alone understood the mold as no one else could, due to his/her experience and expertise. The toolmaker determined actions, fit, and function. The designer determined that there was adequate steel and specific, accurate gate locations, based primarily on trial and error, past experiences, and a product engineer's guidance.

Today, however, mold designers are valuable participants in the design-to-manufacture process of bringing new products to market. They are relied upon for a greater amount of engineering information. Now, mold designers must be familiar with an ever widening variety of plastic resins, be more creative in determining moving actions within a mold, and have a working understanding of new and exotic mold materials.

Newer resins demand more engineering

In addition, mold designers need a working knowledge of, or an excellent resource base for, items such as shear characteristics, shrinkage rates (both in and across flow), chemical reactions with mold materials, and venting requirements. Just as important, mold designers need to understand processing parameters as well as other key issues, such as being familiar with higher operating temperatures associated with exotic molding resins. For example, some of the toughest new thermoplastic resins mimic thermosets in terms of dimensional stability at elevated temperatures.

These resins are injected at temperatures often double that of commodity-grade materials. The molds are usually cooled with hot water, live steam, or hot oil. In these cases, the designer not only has to account for thermal expansion of the mold itself but also provide adequate insulation to isolate the mold from the press. If too much heat is lost from the mold to the platen, the process can be hindered, and the product will be rejected.

Newer resins allow greater complexity in design

Along with the elevated temperatures, product engineers are discovering new ways to add complexity to the end product. Where it was once unusual for a product to require unscrewing actions or side cores, it is today becoming the norm. It is also becoming almost common for a product to require at least one action in a direction out of die draw. Today's designer must recognize these requirements and find a proper cost-effective solution. In addition, depending on the actual molder, tool builder, and the required action, a designer may need to propose several options during the preliminary design phase. Those options may range from a simple mechanical slide to a complex reciprocation unscrewing action. Whichever the case, it is the designer who must find a cost-competitive, durable answer to the actions required.

As a result of all these new requirements, many component manufacturers have begun standardizing items for use in a modular approach to mold building. In this case, the designer not only has the responsibility of designing the mold but also utilizing standardized parts. In Europe, for example, a designer may commit career suicide if asked to detail a part for manufacture that could be purchased commercially. In an industry where lead times are becoming shorter and shorter, the designer has a greater role in meeting the delivery schedule.

The electronic and print engineering libraries are becoming more valuable every day. During slack times, a wise designer spends time becoming familiar with the various manufacturers and components. Thanks to the Internet, information is available 24/7, and geographical and time zone barriers no longer exist. With the use of e-mail and catalog data, purchase orders and requests for quotation can be solicited anytime, in any time zone, and a confirmation will be waiting in the morning. This evolution has helped make the task of securing and reviewing catalog information all the more important.

In some instances, the designer must play the role of salesperson to introduce a new approach to building a mold or using a new standardized component in meeting the product design challenge. Whatever the task, a good designer derives a feeling of success when the mold is finally finished and parts are shot, especially when new technology has been introduced and implemented.

New mold materials require greater chemical awareness

With one eye on cycle reduction and the other on durability, today's designer practically needs a minor in chemical engineering. For example, designers need to understand the relationship of phosphates in a nickel bath to sulfurs in a rubber compound. In addition, they should understand the potential for galvanic corrosion between copper-based alloys and tool steels. What's more, in many cases, designers are expected to determine the proper type of steel for a given set of properties, know the best possible heat treatment conditions, and remember whether the material will expand, shrink, twist, or sag as a result of the heat treatment.

With the introduction of specialty metals — sintered and special grade types — designers must consider what is to be achieved by each selection that is made. Designers should ask, "Is this material being used because it's what we have always used, or is it being used because it is best suited for wear, hobbing, coining or galling?" Whatever the case, the designer is now situated at the front lines in metallurgy. I cannot over emphasize the need to establish and maintain close relations with the metallurgical department at your steel supplier. These resources really know their business and can save a tool from certain disaster when they are involved early in a project that requires their expertise.

New software enhances design

All of the changes occurring in the mold making industry have not happened in a vacuum. The computer industry has provided higher levels of sophistication in the hardware available. The new hardware runs more exotic software and provides more information to the designer. With all of this new technology, the design/build process is being compressed even more. Molds that took sixteen weeks a few years ago are now being completed in as few as eight weeks.

As a result of this flurry of new technology, design engineers are in a constant state of learning. Just when we think we are program-proficient, the next version of the software release hits the street.

In the 1970s, drafting machines with power-rise tables were the hot technology. In the 1980s, a new product called computer-aided design and drafting (CADD) was launched. The 1990s brought solid modeling and the integration of finite-element analysis (FEA) with CAD. The new millennium is focusing on a heightened awareness for the use of mold cool analysis and mold filling analysis. As these tools are refined, the designer of today and tomorrow must stretch his/her capabilities to meet the demands of our industry.

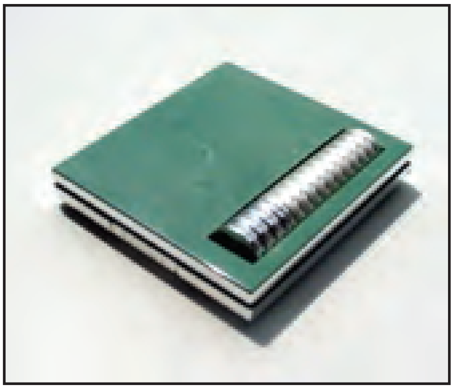
About the author

Scott Peters is the Sales/Engineering Manager for ProMold, Inc. (Cuyahoga Falls, OH). He has worked in the plastics industry as a mold designer and sales engineer for 25 years. For the past six years he has served on the Mold Making and Mold Design Division Board of Directors, Society of Plastics Engineers International. Contact him at slpeters@promoldinc.com, or visit www.promoldinc.com.

Estée Lauder Uses Moldflow Part Adviser to Design Sleek Shapes for Cosmetic Lines

By Laura Carrabine, Editor

The Estée Lauder Companies Inc. is one of the world's leading manufacturers and marketers of quality skin care, makeup, fragrance, and hair care products. The company's products are sold in over 120 countries and territories under well-recognized brand names, including Estée Lauder, Aramis, Clinique, Prescriptives, Origins, MoAoC, La Mer, Bobbi Brown essentials, Tommy Hilfiger, jane, Donna Karan, Aveda, Stila, Jo Malone, and Bumble and bumble. The technologically advanced, innovative company has gained a worldwide reputation for elegant, luxurious products that uphold the finest standards of excellence through extensive research and stringent product testing.



Paul C. Bergmann, director of corporate engineering, is responsible for the makeup development group for all 15 divisions. He uses Moldflow Part Adviser (MPA) software from Moldflow Corporation (Wayland, MA) to take control of designs early on, enabling every part and mold concept to be tested for manufacturing feasibility before the tool is cut, when the cost of change is minimal. MPA, seamlessly integrated with SolidWorks, Estée Lauder's 3D CAD software, allows Bergmann to run simulations and view results directly on the solid model. The software identifies critical manufacturability and quality issues and recommends appropriate actions to address those issues. He also uses COSMOS finite-element analysis from SRAC.

Moldflow at work

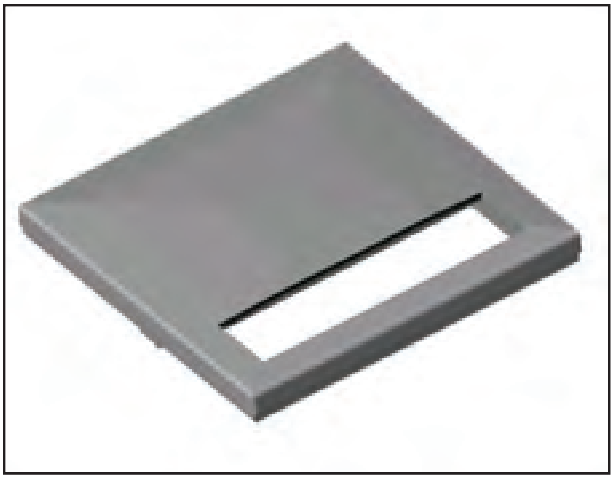
Bergmann and one other colleague have used MPA for more than two years. He says, "Since Moldflow acquired C-MOLD, the technology combines the best of both worlds. We also selected the software because Moldflow is a SolidWorks Gold Partner."

The team also uses a fused deposition modeler, the next generation of stereolithography (STL). "The fused deposition modeler outputs an STL file from SolidWorks. We can make a 3D model right here in my office," adds Bergmann. He creates a totally functional prototype that is accurate to within .005-inch engineering tolerance. "The ability to quickly access the 3D CAD files and turn them around into a working model is essential," notes Bergmann. "To be able to make a 3D object that people can hold, feel, and evaluate is very powerful. Since we have to be fast to market, all of our solid modeling, flow analyses, and FEA are performed concurrently."

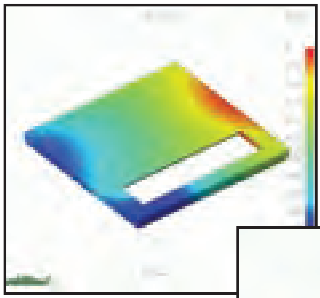
Moldflow to the rescue

The Clinique product line is Estée Lauder's most profitable division. Recently, Clinique designers and marketing groups agreed to provide a product for the travel retail market, such as duty free shops in airports. The groups wanted to provide a Clinique powder compact with a window that showed one of the company's high-end lipsticks packaged inside. The design required incorporating a void in the cover to allow the lipstick to show through. "From a molding perspective," says Bergmann, "this was a tricky job."

"When you add a physical cut-out in the cover such as the one we were considering, it totally affects the plastic flow. In other words, as the flow hits that corner, it wraps around the cut-out and then streaks everything in line like a turbulent jet flow coming around the side. We used MPA to perform a quick, automatic gate locator to see what the software predicted. Typically, the software picks gate locations that are optimum for molding but not necessarily optimum for aesthetics."



Compacts, lipsticks, and other Estée Lauder products all adhere to strict corporate aesthetic guidelines. "We absolutely cannot have a gate located in an area where a woman's hand is going to come in contact with it. All gate locations must be hidden," adds Bergmann.



The biggest challenge with this project was to arrange gate locations to hide knit and parting lines. First, the material supplier made some suggestions about the gate locations. Bergmann performed some MPA flow analyses and was able to narrow the gate selections down to just three to four. Finally, using MPA and COSMOS, Bergmann and his colleagues determined one optimum gate location. "We re-ran the analysis, and to our amazement, the flow along side of the finished piece and the real operation were 100 percent identical. We couldn't have achieved such success without the use of the software as well as the knowledge and expertise that goes behind it," notes Bergmann. As a result of the project, the materials supplier was able to reduce scrap from 14 percent to 4 percent — a savings that will be passed along to Estée Lauder over time.

"That particular project," says Bergmann, "was one of my bonus objectives. I was tasked to implement MPA, become proficient using it, and show justification for its use. Moldflow was very helpful in that endeavor."

He says the software is easy to use and very intuitive. "Since implementing MPA and experiencing so many successes, we have asked most of our suppliers to standardize on SolidWorks. They send us 3D CAD files and I can instantly perform MPA analyses and FEA. We make adjustments to the models and send them back to suppliers so they can update their prints with our changes. Then, they simply send us the final prints and we expedite," adds Bergmann.

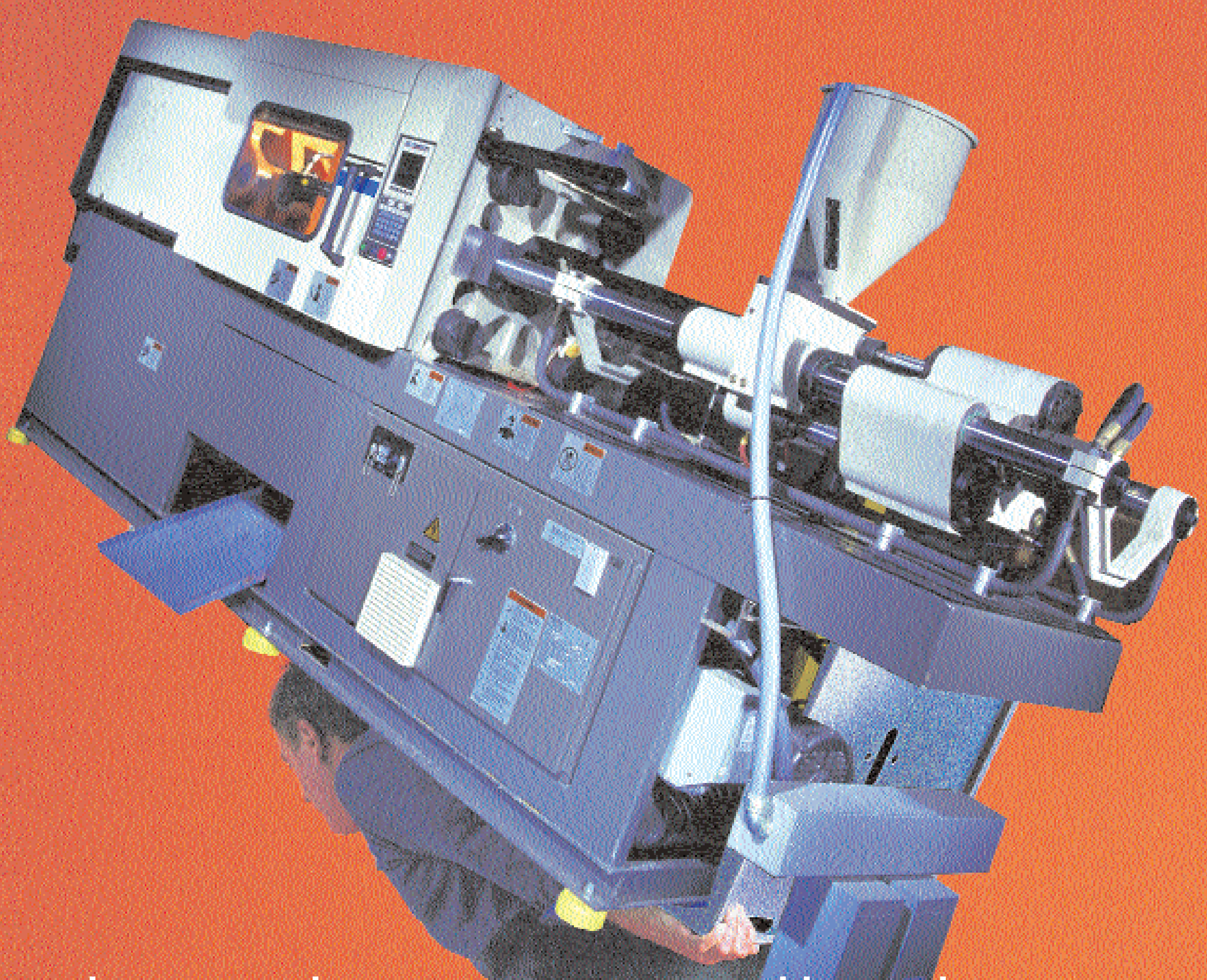
Other MPA successes

The company's Paris-based office launched a lipstick and nail enamel product lines called Pure Color for European sales only. Since the products were wildly successful, the company decided to sell them in the United States exclusively at Bergdorf Goodman and Harry Bendel specialty department stores. Bergmann says, "The design concept of the product resembles a round sphere of color floating in an ice cube. We used MPA extensively in the development of the line, which involved an overmolding process. Gate location can affect flow turbulence. MPA was a lifesaver in that and countless other projects," notes Bergmann. The Pure Color Lipstick sells for $30. Its decorative case touts 24-karat gold and elaborate overmolding detail.

Design challenges

In the fiercely competitive cosmetic industry, every Estée Lauder division strives to provide innovative new products to the marketplace. "We have a lot of latitude in terms of introducing new colors, shapes, and materials," says Bergmann. "The Estée Lauder and Prescriptives divisions, for instance, share the premium price within the market. These divisions prefer to use a lot of pearlized materials and metallics in their classic designs. Those materials are difficult to push through an injection mold. As a result, using Moldflow, we have creatively built runner systems within the parts themselves to channel and predict the optimum flow of plastic. We have been able to eliminate knit lines and flow lines where the pearl material lays out very uniformly. The end product is the best lacquer paint job you've ever seen on a Mercedes Benz," adds Bergmann.

The company's new Estée Lauder Signature 3 product line was developed using MPA and SolidWorks. The product comprises an internal runner system. The exterior is a blend of violet and real crushed pearl. "It's got the hardest top coat known to man right now by Sherwin Williams. The organic coating protects it from everyday use. We want the product to look as good throughout its life cycle as the first day the consumer purchased it," notes Bergmann.

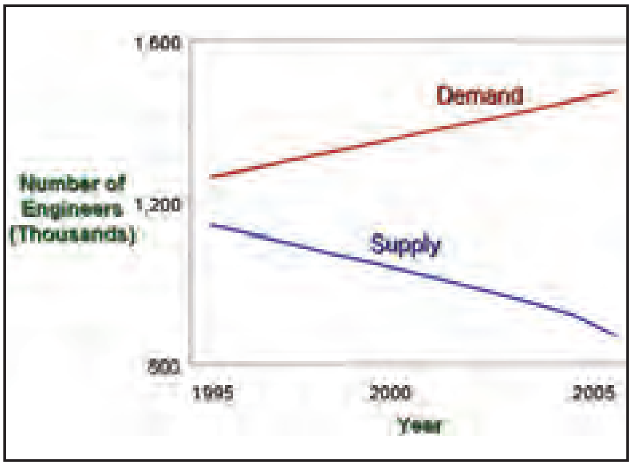


Collaborative Design Becomes an Imperative

By Marc Halpern, Gartner Group Research Director — C-Commerce, Design & Manufacturing, Strategies and Applications

As the engineering talent pool has globally dispersed, Web-based collaboration has gone from competitive differentiator to business necessity, creating work force dislocations and producing new collaborative responsibilities within enterprises. Web-enabled collaboration for product development, manufacturing engineering, and process planning will become more than just a competitive differentiator as we move forward. Current demographic and economic trends make collaborative design a requirement for global manufacturing enterprises that expect to survive and be competitive during the next 10 years.

Demographically, the gap between demand and supply of experienced engineering and design talent is widening in North America and Western Europe, as illustrated here.



Most likely, this gap will widen for the next four years as a result of enrollments that have continuously dropped since the 1970s. The trend accelerated throughout the 1990s. Concurrently, the demand for engineering talent in North America and Europe increased. Consequently, the current engineering shortfall of 25 percent in North America may grow to 40 percent by 2005.

As a consequence, the trend to outsource content creation and manufacturing becomes increasingly compelling. This poses a daunting communication challenge, since enterprises that subcontract engineering work often report that their geographically remote suppliers do not contextually understand their requirements. Consequently, they deliver poorly designed components that require rework at considerable unnecessary expense and time lost.

In plastics manufacturing, iterative and incomplete "low bandwidth" communications via telephone, fax, email, overnight mail, and on-site meetings increase the risk of "communication disconnects" that delay time to market, increase manufacturing costs, and compromise the quality of delivered parts. Major risks relate to decision-making about molds that is not synchronized with the most-comprehensive information about parts. For example, slight changes to part features or the plastic selected can have a big impact on the design and fabrication of a mold, such as gate and runner locations, draft angles, etc. The communication challenge becomes exacerbated as product creation becomes a 24-hour-a-day, seven-day-a-week effort across a global supply chain.

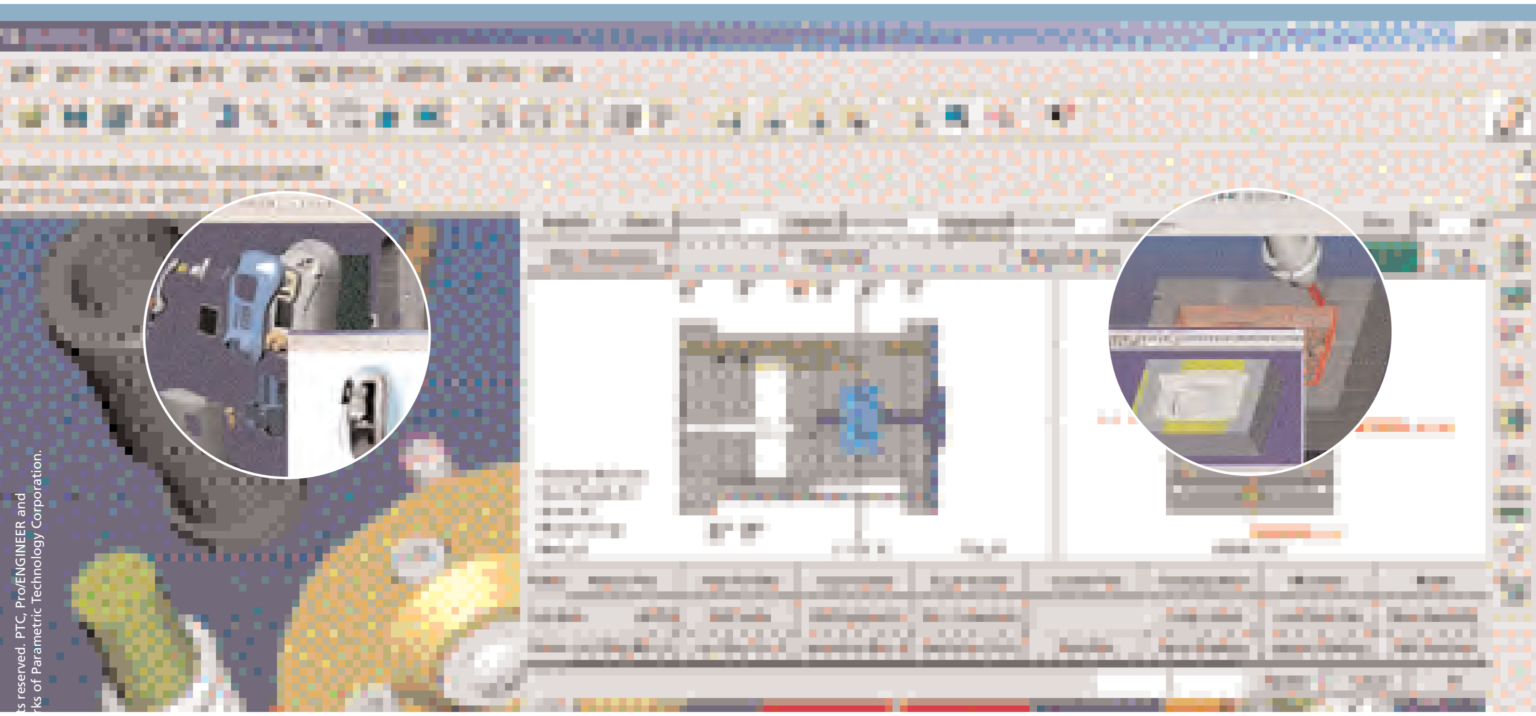
Internet-enabled design and data management applications offer the most viable approach for addressing this global challenge. Web-centric architectures provide the outreach and scalability necessary to enable the required communications bandwidth throughout an enterprise and across suppliers, partners, and customers on a global basis. Collaborative design applications are evolving rapidly in the ability to capture and convey design requirements contextually. Design shops who have adopted collaborative tools to coordinate with mold makers have reported that the timeliness of communication and the broad bandwidth of simultaneous visual and verbal interaction have reduced the time to design competition by 20-30%. They also report significant reduction in costs associated with mold design mistakes.

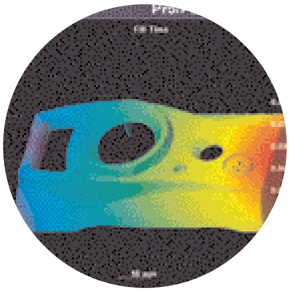
From an economic point of view, enterprises require greater innovation and localization of product content for continued growth in their markets. A collaborative product commerce (CPC) infrastructure allows enterprises to instantaneously communicate localized product requirements from around the world and rationalize them into product platforms. This allows for more proactive planning of part families and molds that support flexible manufacturing. Toward this end, the availability of a globally distributed design team is advantageous, since the CPC architecture enables them to collaborate on the definition of a standard platform that serves each of their markets. CPC support of globally accessible, federated component databases would also enable the product definition team to eliminate redundant components, reduce overhead procurement and manage production schedules.


FREE TEST DRIVE
Z Corporation 3D Printers create physical models directly from 3D CAD data.
We invite you to experience holding a physical model of your design in your hands.
Visit our web site to receive a physical model of a design you are currently working on.
For a free test drive visit our web site:
www.zcorp.com/zoupon/zoupon.shtml
Use the password Moldflow to have your monochrome part printed for free.
All files sent to Z Corporation will be kept confidential.
For more information about Z Corporation's 3D Printers visit our web site at www.zcorp.com.


KRAUSSMAFFEI
C Series Injection Moulding Machines
with Dual-platen Technology


DatapointLabs
expert material testing
Concerned about simulation accuracy?
Good material properties are key to Moldflow simulations. DatapointLabs is the world leader in material modeling for plastics process simulation and structural analysis. We bring you TestPaks™ for Moldflow: material testing to Moldflow specifications, analyzed and ready for use in Moldflow.
precise
confidential
fast & economical
expert materials support
TestPaks™ are the easy answer.
www.datapointlabs.com
visit | browse | buy
1-888-DATA-4-CAE
photo courtesy of Moldflow (2000)
TestPaks™ is a trademark of DatapointLabs. Moldflow is a registered trademark of Moldflow Corp.





Pro/ENGINEER®: Engineered for Innovation in the Mold Industry

It was said that it couldn't be done: Start from nothing, end with a molded part, finish in a day.

Yet, at NPE 2000, this was done not once, but five times. Five days, five different part designs, five different production molds, thousands of injected parts produced, live on the show floor. The software of choice, and the only software needed for the "Mold-in-a-Day" RUSH Technology team: **Pro/ENGINEER®.**

Pro/ENGINEER is the only choice to tackle the whole job, taking industrial design concepts to completed toolpaths with no translations, while permitting last-minute no-penalty changes.

Art to part at breakneck speed.

To learn more about how you can significantly improve your time to market visit **www.ptc.com** Pro/ENGINEER Tool and Die Manufacturing or keyword search: rush.

PTC®
Shaping Innovation