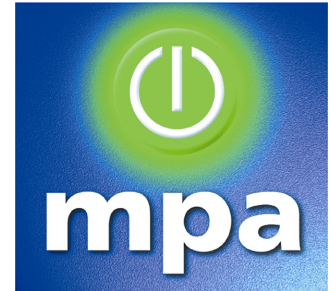


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Moldflow Plastics Advisers™  
Design-for-Manufacture Analyses:



## Solutions for Part Designers

### **Abstract**

For CAE analysis tools to be truly useful, they must provide practical information that drives design decisions. The Moldflow Plastics Advisers™ (MPA™) product line comprises two commercially available modules, the Moldflow Part Adviser™ module and the Moldflow Mold Adviser™ module. The Moldflow Part Adviser module addresses the specific analysis needs of plastic part designers, while the Moldflow Mold Adviser module provides additional capabilities that target the needs of mold designers.

This white paper describes the Moldflow Part Adviser module and how its capabilities benefit part designers.

# Moldflow White Paper

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## Introduction

Moldflow Part Adviser software gives part designers the tools to optimize their part designs and check the impact of critical design decisions on the manufacturability and quality of the product. Moldflow Part Adviser is completely integrated with the designer's CAD environment and works directly from a 3D solid model without the need to create a mesh or midplane model.

To get started, just follow two simple steps:

- Select a plastic material from the database.
- Launch the Analysis Selection Wizard.

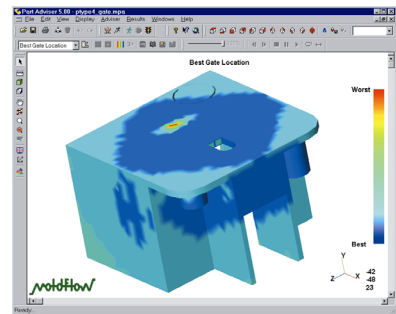
The Analysis Selection Wizard enables users to launch all MPA analyses from one location. The Analysis Selection Wizard clearly indicates what analyses are available and provides a brief description of each analysis. It also provides feedback about what input information is missing if a particular analysis cannot be launched. This key feature permits even first-time users of MPA software to become productive immediately.

## Optimize Part Design Manufacturability and Quality

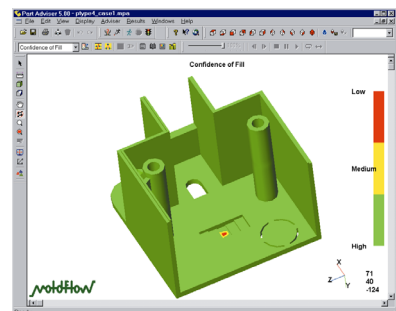
Moldflow Part Adviser analyses identify critical part-design manufacturability and quality issues and recommend appropriate actions to address those issues.<sup>1</sup>

The very first and most important question users have when they want to perform a flow analysis on their model geometry: "Where do I place the gate?" Moldflow Part Adviser software provides a Gate Location Analysis to answer this question automatically. The color-shaded display indicates which areas of the part are the best locations for gating and areas that are wholly unacceptable. Detailed information is provided to give users real-time feedback on why the identified locations are good or bad.

A fundamental design consideration for injection-molded parts is, "Will it fill?" The Moldflow Part Adviser software provides a design-specific output, Confidence of Fill, to answer this question straightforwardly. The results are plotted in a three-color display



**The Gate Location Analysis identifies which areas of the part are the best locations for gating.**

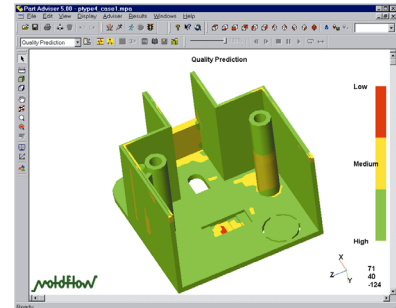


**The Confidence of Fill plot highlights areas where filling problem may occur.**

<sup>1</sup> Moldflow Mold Adviser provides additional mold-design capabilities that are described in the *Solutions for Mold Designers* white paper.

according to a traffic-light analogy: green indicates which areas of the part have high confidence of fill, yellow indicates some filling problems may occur, and red indicates areas that are not likely to fill. While the plot is simple and easy to interpret, the underlying technology used to create it is not. The Confidence of Fill predictions are based on an advanced analysis of cavity pressures, temperatures, and injection short shots.

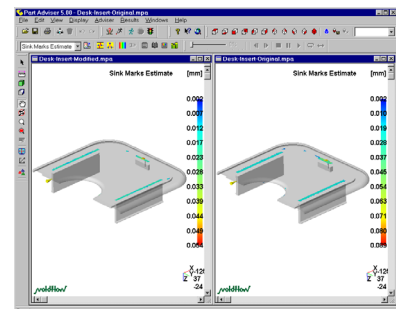
Once a filling analysis is complete, the Moldflow Part Adviser software also provides a design-specific output to predict molded part quality using a similar green-yellow-red display. The Quality Prediction result accounts for flow properties (such as shear stress, shear rate, cooling time, flow front temperature, and pressure drop) to determine which regions of the part may have quality problems. Part quality is an important variable for designers to consider, because even though a cavity may fill, excessive material shear, for example, may drastically reduce the mechanical strength of a molded part, which could cause premature part failure or a reduction in service life of the part.



**The Quality Prediction plot highlights potential quality problems.**

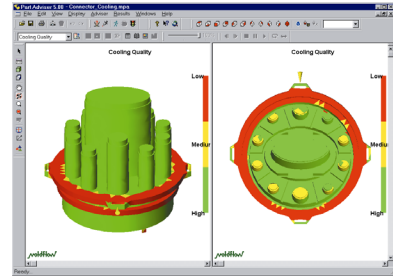
Weld-line and air-trap locations can be superimposed over any other Plastic Flow Analysis result plot. Weld lines, in particular, may affect the visual quality as well as the structural properties of a plastic part. For example, looking at weld lines on an injection pressure plot will give some idea of weld-line integrity. If major weld lines occur in areas that fill under low pressure, these areas may be weaker than other areas of the part where no weld lines occur, or where weld lines form under high pressure. Part designers can use this information to evaluate design changes intended to move weld lines and air traps to less-sensitive regions of the part or to eliminate them altogether.

New in the MPA 5.0 release, the Sink Mark Analysis uses the results of a filling analysis as input to locate areas where sink occurs and estimates the depth of each sink. Sink marks are often associated with thick areas of a part, particularly on surfaces opposite to features such as ribs, bosses and gussets. Sink marks affect the visual quality of the part and are undesirable, especially on aesthetic surfaces. Part designers can use the results to identify potentially critical sink marks and eliminate them through changes to the part design.



**The Sink Marks Estimate plot shows the effect of design changes on sink mark severity.**

Also new in the MPA 5.0 release is the Cooling Quality Analysis, which identifies areas where heat is concentrated on the part and also quantifies the variance in surface temperature and freeze time across the part. Heat concentrations may occur in thicker sections of the part, at sharp corners, in deep cores, and where several geometry features are very close together. Excessive heat can lead to longer cycle times and contribute to the formation of sink marks. Part designers can use the Cooling Quality Analysis results to identify areas that need attention and compare the effects of design changes.

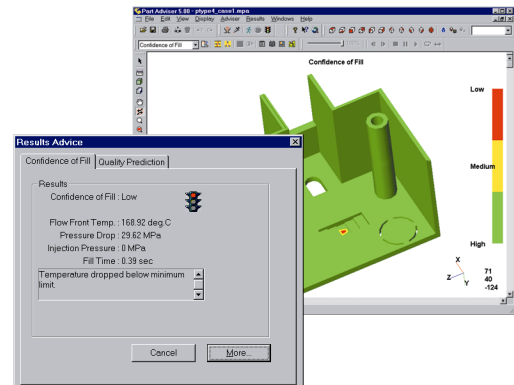


The Cooling Quality plot identifies areas where heat is concentrated on the part.

### Find Practical Advice to Address Design Issues

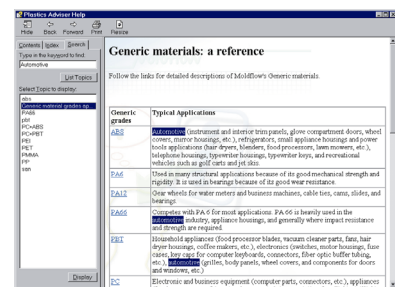
What if Moldflow Part Adviser analysis results identify a design issue? The program goes beyond problem-identification to provide practical design advice to help users address those issues. The Dynamic Adviser displays the underlying numeric values used to create the plot at each point, and text information about why a problem occurred is instantly available. Then select the More button on the Dynamic Adviser to access online advice on how to correct the problem.

For example, when using the Dynamic Adviser with the Confidence of Fill plot, values for fill time, pressure, temperature and pressure drop will be updated dynamically based on the position of the mouse. In yellow and red areas that indicate regions of the part where filling could be difficult or impossible, the Dynamic Adviser describes the underlying reasons for the problem and suggests design changes that could lead to the part filling completely. This drill-down approach is fundamental to how the MPA software provides practical design advice: the program provides active feedback and does not assume that you know where and how to look for it.



When used with the Confidence of Fill plot, the Dynamic Adviser suggests design changes to address filling problems.

The online help included with the MPA installation provides review information to support design principles, as well as



Comprehensive online Help provides detailed information about the fundamental principles of plastic part design.

multimedia demonstrations of design concepts and numerous online tutorials, each one created to reinforce the fundamental principles of plastics part design. What this amounts to is a built-in design guide that is always at a designer's fingertips. At each stage of the design process, designers can consult this area for specific recommendations that cover topics such as repositioning weld lines, avoiding hesitation, and the relationship between part thickness, polymer flow, and cycle time. Every critical design issue is fully defined and explained, and specific, tried-and-true design recommendations are provided for each issue.

## Link Design to Manufacturing

New in the MPA 5.0 release, a Cost Adviser tool in the Moldflow Part Adviser module allows part designers to quickly estimate the production cost associated with a particular part design and to assess the cost impact of a design or material change. The Cost Adviser estimates the preliminary part cost based only on material cost, machine rate and production volume information.

Input	
Targeted parts production	10000 parts
Material price	\$1.000 /kg
Machine rate per cavity	\$2.100 per hour

Default	
Part per volume	4.621 cm³
Estimated cycle time	6000 seconds

Output			
Total material needed		Cost breakdown	
Total material needed	46207 kg	Material	\$4.621 (\$2.540 %)
Material cost per part	\$4.621	Machine	\$2.100 (\$0.462 %)
Machine cost per part	\$2.100		

Cost Estimate	
Total Cost per Part	\$6.721
Total Cost per Production	\$672100

**The Cost Adviser facilitates estimating the impact of design or material change on part cost.**

MPA software also can export a file that can be input to Moldflow Plastics Xpert™ (MPX™) software. MPX software interfaces with the injection molding machine controller and allows users to set up, optimize, monitor, and control the injection- molding process with a simple, systematic, and documentable method. The MPA output file provides starting points, including shot size, injection velocity, cooling time, etc., for the MPX optimization functions.

## Facilitate Design Team Communication

Designing plastic parts is a collaborative effort. To minimize manufacturing problems and optimize part quality, part designers, mold designers, material suppliers, molders and others should all be involved as early as possible in the design process. MPA software automatically generates Internet-ready reports to facilitate communication among all members of the design-through-production team. Using these reports enables team-driven design optimization by allowing timely communication of design concepts from part designers and early review and feedback about manufacturing constraints from other team members.

## Summary

Moldflow Plastics Advisers software provides design-for-manufacture analysis tools to meet the special needs of plastic part designers with the Moldflow Part Adviser module. Moldflow Part Adviser features allow part designers to identify and address critical manufacturability and quality issues in the earliest design stages. The software provides practical design advice targeted for specific users and tasks through a drill-down approach that starts with the big picture and lets users progress to the level of detail required. In addition, MPA software provides

a direct link to the molding shop floor through its interface with Moldflow Plastics Xpert software and provides special reporting features that facilitate communication among all team members.

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### **About the Moldflow Plastics Advisers Product Line**

With the first launch of the Moldflow Plastics Advisers (MPA) product line in 1997, Moldflow Corporation introduced a new paradigm for applying simulation technology in the preliminary stages of both part design and mold design. MPA software modules are solids-based to analyze CAD models directly. There is no need to translate geometry or perform complex FEA meshing tasks. The software is easy to learn and use and does not require extensive training or expertise in plastics. Using MPA tools, part and mold designers can test every part and mold concept for manufacturing feasibility before the tool is cut, when the cost of change is minimal. MPA analyses provide effective and functional solutions that allow plastic parts and molds to be designed for manufacturability, as well as for form, fit and function.

For more information about other Moldflow products and services, visit [www.moldflow.com](http://www.moldflow.com) or [www.plasticszone.com](http://www.plasticszone.com).