3D Shapes, Inc.

Defining "Moldflow" Analysis: MPA

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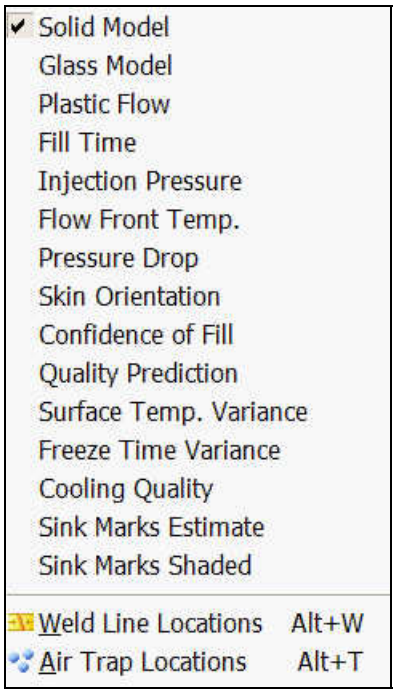
MPA or **M**oldflow **P**lastics **A**dviser is plastics analysis software intended for the more casual analyst and is easier to use than the high-end MPI **M**oldflow **P**lastics **I**nsight. The user never sees a finite element mesh and there are fewer options for the analysis and results.

MPA has several variations available. Therefore, not all MPA much less Moldflow analyses are necessarily the same. The primary MPA products are Part Adviser and Mold Adviser. Many companies that offer "free" analysis and software offered as an add-on to CAD packages is usually Part Adviser. Moldflow's standalone list price for a seat of Part Adviser is $7000.

What are some of the most significant limitations? Part Adviser does not allow modeling of gates or runners. Part Adviser does not account for fiber effects in fiber-filled materials. Part Adviser does not analyze the post-filling stage.

The following results are available from Part Adviser:



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As you can see, the results primarily relate to fill pattern, injection pressure and part temperature. If these results solve the questions that you have, then MPA is a good solution. Often questions for Part Adviser will be design-type issues related to general part design, wall thickness, comparing materials, fill pattern and weld lines.

For a tool maker, the analysis may focus on the number and best locations for gates. The analysis cannot include the actual gate geometry, it will just include "inlets". This makes the assumption that the gates will be appropriately sized.

What's the Deal with the Mesh?

MPA is mesh-less but not really, it's just that the user never sees the mesh. For a casual user this is good - dealing with the finite element mesh usually requires a lot more time and knowledge.

Earlier methods for plastics analysis involved a mid-plane or shell element mesh. While some parts are still best analyzed using these methods, often it adds a great deal of time and expense to the analysis. A mid-plane mesh appears to be a paper thin 3-D model most correctly modeled at the middle of each wall section.

For a rectangular plate that is 0.125" thick, a rectangular set of elements is created and assigned the thickness of 0.125". The key here is that the thickness is *assigned* to the elements and is not apparent from the images. Largely due to the high degree of user interaction a mid-plane based analysis can be some of the lowest overhead and most accurate analysis available.

For years software suppliers have sought the "holy grail" of automatic mid-plane generation. A flat plate it is relatively straightforward but, as you can imagine, for a typical injection molded part it can be very difficult.

To their great credit, Moldflow Corp. sought a different solution and came up with their patented "dual domain" methods. With MPI this dual-domain mesh is called a Fusion mesh.

For MPA analysis, the software evaluates the part and tries to pair elements based on what it interprets as inside and outside walls. Elements are matched and edges of the part are assigned as edge elements. While this method is surprisingly accurate in many cases it does tend to introduce errors. The difference is that with MPA you don't see the errors and can't directly fix them whereas with MPI you can see them and fix them.

If you are a MPA user and would ever like to see the mesh, use the SAVE AS feature and save as a UDM file. Send the UDM file to 3D Shapes. We will read it into MPI and show you the finite element mesh file that MPA is using and the assumptions that it is making.

If the part geometry is appropriate, MPA results will be very accurate. In fact, Part Adviser uses the same materials database and solvers as the high-end MPI product. However, if the part geometry is extremely complex with many thick sections and transitions then the results may be very inaccurate. MPA does provide warnings if this is the case. If analysis is completed by ignoring the warnings errors introduced and if you did not do the analysis you may never know it.

A dual-domain mesh makes it appear that a part has been run with true 3-D analysis but this is not the case. The analysis has been run on a matched mesh that exists on the entire boundary of the part. If you section or "clip" the part you will see that there are no results across the thickness. To see results across the thickness you need the true 3-D analysis which is offered through MPI. This can be very useful if a part has many thickness transitions or thick areas. Evaluating across the thickness can help minimize shrinkage and sink issues.

With Version 7 of MPA a high resolution analysis was introduced. This creates a much finer mesh. It will significantly increase run times for the analysis and will also usually give you more accurate results. When running multiple analyses on the same part, combining low resolution and high resolution analysis can be an effective strategy to maintain accuracy yet reduce computation time.

Perhaps one request you can make from suppliers offering you free or low cost MPA analysis is that they provide you with the ADV or UDM file as well as their summary analysis report. This way you can either see how good the assumptions are or you can possibly carry the analysis on with Mold Adviser or MPI.

This can be a good way to carry out simple analysis up-front and move to more complex and informative analysis as your project moves into manufacturing. This, in fact, was the thinking for MPA – it was not intended as a replacement for MPI.

Ask the analyst what software they are using for the analysis. Specifically, you can ask them if they are using Part Adviser or Mold Adviser. If they can't even answer that question for you, you should be particularly wary. Be sure that if they claim they will provide cooling results that it is not just the very basic Part Adviser output. Ask them if the analysis will evaluate post-filling as well as filling. You can't do post-filling analysis with Part Adviser. Hopefully, you are beginning to see why a "Moldflow" analysis can mean many different things.

There are many examples where Part Adviser will not be the best solution. For example, with a living hinge there will not be a sufficient number of elements to accurately evaluate the shear effects in the hinge. With a "thick and chunky" part the elements may not be properly matched or assigned.

Originally, MPA analysis was completed only with the common STL file format. With the appropriate translators MPA can now directly read in Solidworks, ProE, Catia, Parasolid, STEP and IGES files.

iMPA is an "Internet-enabled" version of Part Adviser. The current version of Part Adviser is 7.1 whereas iMPA is set at Version 5. There have been significant enhancements to MPA since V5 including changes to the material files regarding no flow/transition temperature and revamping of the solvers. Version 7 also allows a high resolution analysis as described above.

iMPA "fingerprints" your file allowing you to run multiple iterations on the same part file at a fixed cost. Please note that 3D Shapes will match Moldflow's pricing and run the same resolution analysis with V7.1. You will have the added benefits of 3D Shapes' expertise in running the analysis and interpreting the results as well as many options should you choose to take the analysis further or run it at a higher resolution. Additionally, all analysis costs will also be applied to our ConsultToOwn program.

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