## Flow Analysis Software Evaluation

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THE BRIEF

The aim of the analysis is to trial and prove the effectiveness of various mould flow analyses software in order to aid mould tool design, decrease common filling issues and tool modifications after job completion. All analyses are based upon the same problem part, which is proven difficult to fill by experience. Each software will be ran until adequate results have been achieved.
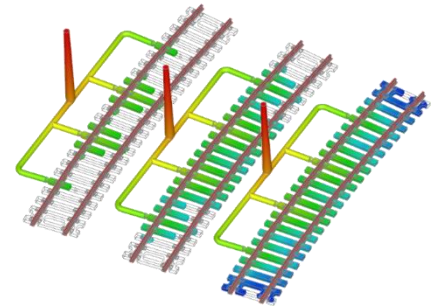
SOFTWARE USED FOR CONSIDERATION

There appear to be two main players in the industry (Moldex3D and Autodesk Moldflow) and two others for serious consideration (VISI flow and SolidWorks) listed as follows.

1. Moldex3D eDesign R16
2. Autodesk Moldflow Insight Standard 2019
3. VISI Flow
4. SolidWorks Plastics Premium

All software's will be trialled using the same parts and will be evaluated based upon several factors:

1. Ease of use:
   - The rate of smoothness, accessibility and the ability to have a good work flow.
   - The inclusion of online (or included) help files and/or tutorials
   - Results and ease of interpretation of results (can I understand what is presented! Does it meet our requirements? Can it advise on mould settings?)
2. Functionality:
   - Family mould tooling (Multiple cavities of different components e.g. kits on sprues, and still be able to use gate and runner wizards) single part analysis is only suitable for part design and offers little in the way of mould tool development advancement
   - Insert over moulding, for observing effects of inserted (over moulded) metal inserts on model, e.g. warpage effects and non-uniform shrinkage
   - Geometry advice (runner, gate and cooling channel advisors)
   - Incorporation/simulation of tooling parts (plates, cooling etc.)
3. Run time of the simulation.

SOFTWARE ANALYSIS 1: AUTODESK MOLDFLOW INSIGHT

One of the industry leaders, started as Moldflow many years ago and were bought up by Autodesk.

Pros

- Pretty, graphically very good
- Simple and easy to navigate ribbon interface
- Good workflow
- Easy to use

- Good online tutorials and help
- Excellent display of shrinkage and warpage results and sinkage areas
- Insert over moulding
- Very thorough results, too many to list
- Advisor very good, view results click on area and suggestions on remedies to problem zones
- Many options and functions, I have ran an extensive trial and still only scratched the surface
- Great customer service and support, the onsite meeting exceeded expectations

Cons

- Subscription only license, with confusing license structure - very expensive for Insight packages
- Charge is made per/annum

The standard of software we require would be Moldflow Insight Standard. The higher options would have too many features not relevant to what we do. Moldflow Advisor would not give us enough to properly refine our parts to prevent issues with venting and over moulding. Although still a very good and capable software and would still be beneficial, the comparison is compared to other software's trialled.

SOFTWARE ANALYSIS 2: MOLDEX3D MOULD FLOW ANALYSIS AND DESIGNER

Moldex are the other go to program for mould flow analysis, arguably on a par with Autodesk Moldflow and indeed preferred by some companies.

Pros

- Moldex uses a "designer" program to process the model and prepare it for flow analysis, what I particularly like about this is that it keeps the part and tool analysis separate from the flow analysis and everything is very intuitive through a step by step process from defining the part then to a rough tool plate through to cooling channels etc.
- Runner analysis and gate analysis are very good, Moldex allows me to analyse a family of parts and suggest ideal gate locations for all of them, will model and balance runners and gates e.g. allow 6mm runners to 2 cavities and 2mm runners to smaller parts on the same tool to balance flow, whilst I'm sure Autodesk Moldflow (at the right license level) will also do this it just doesn't achieve it anywhere near as easily
- Analysis bodies are very easily editable (runners, gate, cooling channels etc.)
- Great work flow and design wizards that have a good impact on design choice
- Excellent visualisation of warpage and sinkage
- Insert over moulding
- Excellent prediction of non-uniform shrinkage (insert over moulding e.g. track and points.)
- Very thorough results, too many to list
- Excellent support and tutorials

It also allows for part modifications whilst your last attempt is running in the other window. Very handy if significant changes are being made to runner and gate balancing that you just want to "try".

Cons

- Old fashioned interface, however most of toolbars are not required to produce analysis, the look isn't 'clean' however everything you require is on one toolbar it's just working out which icons do what
- The new Studio interface looks more like Autodesk Moldflow, but this wasn't used for the evaluation

SOFTWARE ANALYSIS 3: SOILDWORKS PLASTICS

Flow simulation software from SolidWorks, a product aimed with a premium feel.

Pros

- Results advisor very good and good advice given for trouble areas
- Not quite as taxing on the computers processing power (not all the time it will run the ram and cores up intermittently)
- Premium look and feel with good interface
- Nice looking and clear results, although not as many as the two front runners (Autodesk Moldflow and Moldex3D)
- More flexible than VISI's offering
- Runner balancing and gate advisor

Cons

- Mesh calculation is very slow
- Fill analysis (flow, cool, pack and warp) is also very slow and had to be left running overnight
- In order to run SolidWorks plastics, you need a license for the SolidWorks main software. This means parts would have to pass through 2 dedicated cad systems to get a result to then be returned to VISI for the final part/tool to be modelled. (Switching from VISI to SolidWorks and back again) This seems to be unnecessary and also would drive costs up exponentially as you would need an extra seat of SolidWorks as well as a license that would include plastics

SOFTWARE ANALYSIS 4: VISI FLOW

Native flow software for our current cad software, tied to VISI and operable from inside of source part file.

Pros

- Sits inside current software
- Great customer service
- Familiar interface
- Easy to make modifications without exiting software
- Easy to understand (or familiar) results
- Reasonable workflow
- Design tree and tied in to VISI mould module so runners can take influence from the mould tool builder
- Features cooling, warpage, sinkage and ovality results amongst many other results

Cons

- A bit clunky in flow setup
- No gate advisor
- No runner balancing or advisor
- Slow
- No tutorials
- I still have to design a 75% complete part before the first flow sim's can be carried out, (e.g. with no gate or runner advisor) I feel this would offer us little more in the way of design improvements and would prove to be laborious

It is my opinion that this software add-on would be of benefit but lacks the influence on initial part design that Autodesk and Moldex have.

SOFTWARE ANALYSIS COMPLETION TIMES

Moldex3D: less than 20 minutes, results viewable after each individual operation is completed.

Autodesk: 20 minutes, results viewable after each individual operation is completed.

VISI**:** 5 minutes for the initial fill cycle I found getting the other operations to function at a reasonable speed and getting the data to be accepted by the operations tricky and a bit clunky. Ultimately I did not complete the task in an orderly time before my trial license expired. I am sure with practice this would be almost as quick as the 2 front runners.

SolidWorks**:** 3 hours of work time and an unknown amount of time overnight. Assuming (kindly) 30% was completed before leaving the building a considerable amount of time was left to run, it did not tell me the cycle time upon my return. This is unacceptable.

Price:

VISI: Here VISI wins, by far the most cost effective

Moldex3d: Second

SolidWorks: Third (+ extra SolidWorks seat)

Autodesk Moldflow: Most expensive per/annum although they are currently calculating a discount for us that will last 1 month from issue

Conclusion

After extensive trials I have rated each of the software's based upon software functionality first with financial constraints second. At the foot of each evaluation report I have rated them with my overall opinion of the software. It is worth noting that all the software's tie in with models or meshes produced by VISI very well.

The onsite meeting with Autodesk went very well, they were impressed with what I had covered during my trial and this enabled them to focus on the options I did not get time to use or did not discover during my trial license. After our onsite meeting they have agreed to offer a discount to make it more appealing, but the value of said discount is not yet known. In part this is because they will only guarantee a quote for one month so we agreed to discuss it at a later date to ensure the best deal for the company.

Moldex3D gets the current winning vote based upon functionality and price. I have had a second webinar with Moldex3D and went into detail with some options I am very interested in but had not had the time to find myself. Louis Barnes at Wilde Analysis requested I send him a couple of files that he could evaluate outside of our typical format, I sent the ST-238 and the platform accessories tool. These were chosen because the ST-238 is a simple piece of track with insert over moulding so I wanted to see what it could do in the way of warpage prediction and non-uniform shrinkage and it did not disappoint. Louis filled from a single gate so whilst this is not how we would make the tool it really highlighted the need to be in control of tool designs. Using the middle sleeper with a single gate he was able to successfully fill and pack it. He then demonstrated how warpage will affect the part with the rail inserts as part of the calculation. The part predictably warped quite a bit, to my surprise nearly 1mm of deviation occurred from the centre of the part. He did mention that (as we do) gating to every second or third sleeper would have a noticeable impact on warpage of the part. The part would be filled more evenly and not get over packed on sleepers nearest the gate, resulting in less stresses and warpage, weld lines are somewhat a fact on the parts we make. He then went on to demonstrate how Moldex3D would calculate the shrinkage occurring in the part from moulding conditions which again was very interesting. Across the length of the part there was only 0.12% shrinkage due to being held rigidly by the rails whilst the shrinkage across the unconstrained width was a surprising 0.699%. Which suggests that we can no longer use a standard across the board value for shrinkage and create better and more accurate parts especially across parts with large shrinkage values or large parts.

It has very similar functionality and options to Autodesk but isn't graphically as good, this is not a problem and helps with computer and calculation speed. Also it treats the fill, cool, pack and warp as separate operations within the same calculation window, the good thing about this is it splits them into separate analysis threads meaning that once "fill" has completed for instance, I can then start to review the results of this analysis whilst the remaining calculations are still in operation.

All the software's have very good visualisation and animation of all results and good advisors for refining the given model.

I was really hoping that VISI Flow would be the one due to being an internal add in and the great customer support. However it lacks functionality of the other three software's as they believe it to be unnecessary and to lead you down the garden path with designs.

I also found the runner wizard is not the best and wants to use one size of runner for all cavities which makes the family tooling we produce awkward. VISI also seemed to be a bit clunky, a lot of failed attempts occurred as it requires more definite information than the other software's. This essentially means that you would need to design tools and parts at the same time in order to have the information required to run the flow analysis which (in my opinion) is not far enough divorced from the way we work now.

However for ease of use, speed and cost it still managed to beat SolidWorks plastics. Also worth noting that if budget is a major concern (and I'm sure it is.) VISI Flow could manage to creep into second place!

I found SolidWorks plastics a little bit of a sticking point and really had to try quite hard to extract the results as smoothly as the other software's. Some of this may be down to rustiness with how SolidWorks operates

to be fair but this is not the only issue here. SolidWorks requires a file that it can read from VISI, in this instance I used .step files, upon import SolidWorks wants to run import diagnostics on the part and then fills the design tree with the features of the part (bosses, extrudes, fillet rad's, chamfers etc.) which ultimately become a hindrance in part alterations. Essentially this means that to easily make changes I would end up continually returning to VISI to make alterations quickly (and history free) to analyse a fresh run.

The data required for gate placement and some other operations is bizarre at best. But again this can be attributed to my rustiness on SolidWorks in part, however not entirely when compared to the other software's ease of use in alterations. The meshing in SolidWorks is slow. So slow. What is a simple save as in VISI or a couple of minutes from part to mesh in Autodesk or Moldex3D in SolidWorks can take half an hour. The speed of calculation I shall go into in a moment but in SolidWorks this is also painfully slow. Using a small and fairly simple although detailed part, it took over half an hour to mesh it and I left the calculations running for 3 hours before having to give up and leave my computer on overnight to complete. I'm afraid unless there was something I was missing in process this for me is unacceptable on such a small part and fills me with dread of how long it could potentially take on a kit type sprue over a whole 210x170 Meusberger insert.

The results from SolidWorks are a plus point but come this far down my conclusion because the other factors far outweigh this positive. Warpage and sinking are displayed well, the ability to query an area and receive advice on potential problem zones is on a par with Autodesk and I liked it a lot eventually.

When SolidWorks software costs equal that of Moldex3D (more once an extra seat of SolidWorks is accounted for) I am afraid its functionality and workflow can't hold a candle to any of the other software's trialled except maybe VISI but there is a reason VISI fared better in my evaluation. I can live without one or two results in favour of speed.