Autodesk® Moldflow Insight 2025

Validation of Solver Changes

Executive Summary

The Autodesk Moldflow Insight 2025 and Autodesk Moldflow Adviser 2025 software releases includes:

1. Improvements in the 3D Flow temperature calculations for more accurate predictions of Flow Front Temperature (FFT) and injection pressure for all supported processes. In this report, predicted temperature profiles across thickness and FFT are compared with measured temperature data available in literature [1]. Good agreement is achieved between predicted and measured temperature data. These accuracy improvements also bring FFT and pressure results from 3D Flow analysis in better agreement with the corresponding results from Dual Domain (DD) Flow analysis.
2. Speed improvements in the 3D Flow and 3D Warp solvers resulting in reduced computational times without compromising solution accuracy. The extent of the speed improvement varies based on model complexity and analysis types, with notable gains in studies involving compression and injection compression moldings, core-shift analyses, gas-assisted injection molding, and certain fiber orientation analyses. This report provides a comparative analysis of computational times between Autodesk Moldflow Insight 2024 and Autodesk Moldflow Insight 2025 across a diverse range of analysis types.

Contents

3D Flow Temperature Improvement

For numerical analysis of injection molding and/or compression molding processes, the calculation domain keeps evolving during the mold filling stage. The coordination of melt front advancement with the onset of thermal calculations is critical to the overall accuracy of Flow analysis. In the Moldflow 2025 release, the onset of thermal calculations at a cavity node in a 3D Flow analysis has been adjusted to better match the arrival of polymer melt at that node. This adjustment also makes the 3D Flow solver more consistent in temperature solution with the Dual Domain Flow solver.

Comparison with measured data

Actual filling pattern and measured temperature profile data for a plaque mold equipped with glass inserts and melt temperature sensors were published by Murata et al. [1]. Figure 1 which illustrates the shape and dimensions of the cavity, is a replication of Figure 3 from the original publication [1]. The melt filling patterns were obtained through the glass inserts specially designed for observation of the polymer advancement inside the mold cavity. The melt temperature distributions across the cavity thickness were measured at locations A (center line of cavity) and B (side of cavity) using an integrated thermocouple sensor. The experimental data for the material of General-Purpose Polystyrene (GPPS), injected at constant flow rate of 18.8 cm^3/s with melt and mold temperatures set at 200 °C and 50 °C, respectively, are used in this report to compare with the predictions from the Moldflow 3D Flow solver.

Figure 2, a partial duplication of Figure 6 from the original report containing the original experimental data [1], shows the measured temperature across the cavity thickness (3 mm) at locations A and B. The measured temperature profiles are reproduced and compared with the 3D Flow analysis results in Figures 3 and 4 for locations A and B, respectively.

The comparisons demonstrate that the predicted temperature profiles from Moldflow Insight 3D Flow analyses agree well with measured temperature distributions at both locations. The differences in predicted temperature distributions between Moldflow Insight 2024 and 2025 releases are very small.

The temperature value at the mid-layer position (1.5 mm) across the thickness when flow front arrives is defined as Flow Front Temperature (FFT). Both Moldflow Insight releases 2024 and 2025 predicted the same FFT at locations A and B. Predicted FFT of 204.3 °C at location A (center line of cavity) is slightly higher than the measured FFT of 201 °C, whereas at location B (side of cavity) the predicted FFT of 208.1 °C matched well with measured value of 207 °C.

Higher FFT at location B (side of cavity) than location A (center line of cavity) is expected to promote melt flow along the sides of the cavity. This is confirmed by the actual filling pattern shown in Figure 5, with melt advancing faster along the sides of the cavity. This characteristic is captured reasonably well in the Moldflow 2025 3D Flow analysis.

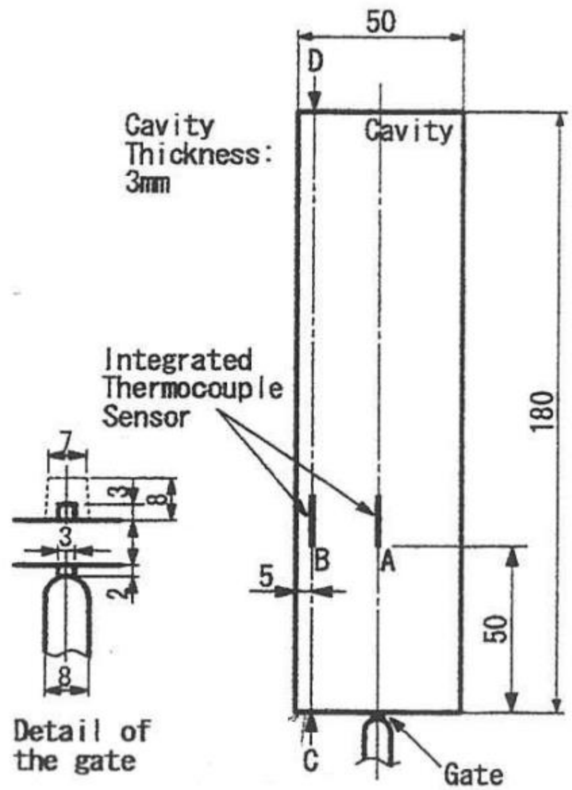

Figure 1: Cavity shape and dimensions (in mm) [1]

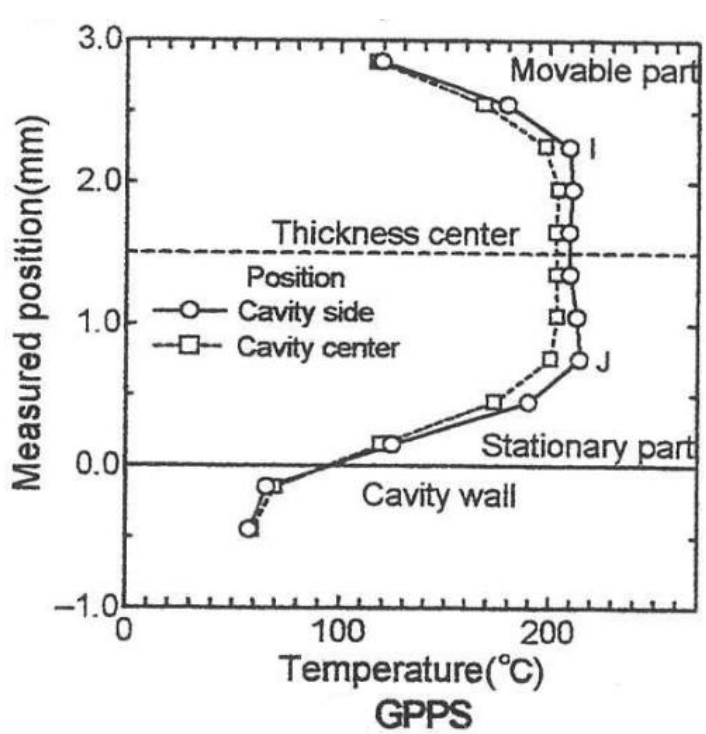

Figure 2: Measured melt temperature distributions across the cavity thickness for GPPS.[1]

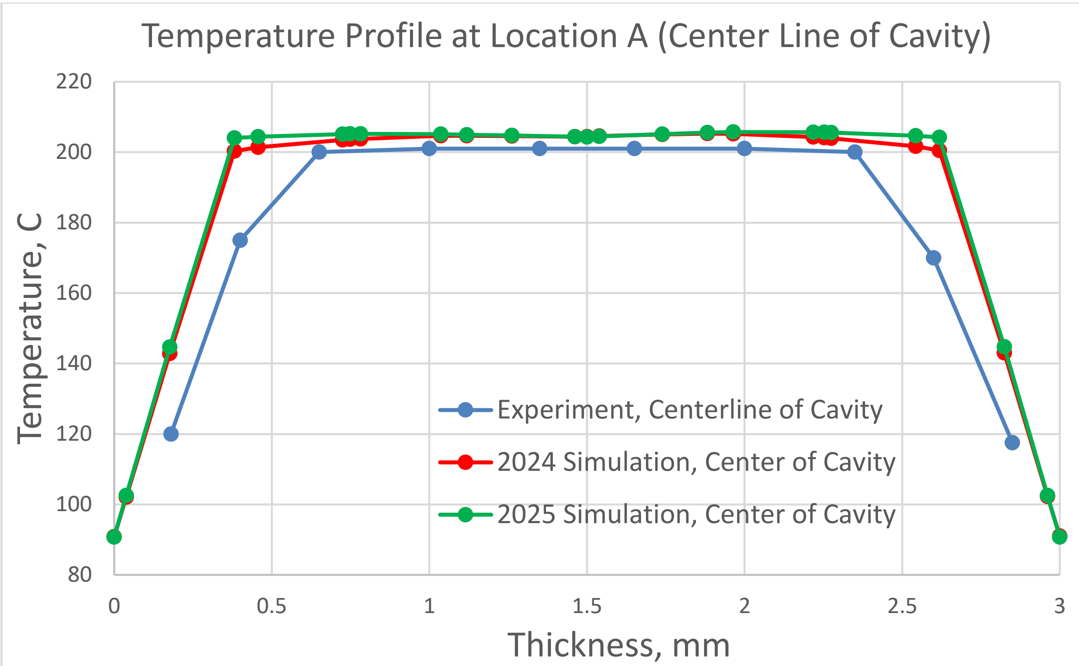

Figure 3: Comparison of measured and predicted temperature distributions at location A.

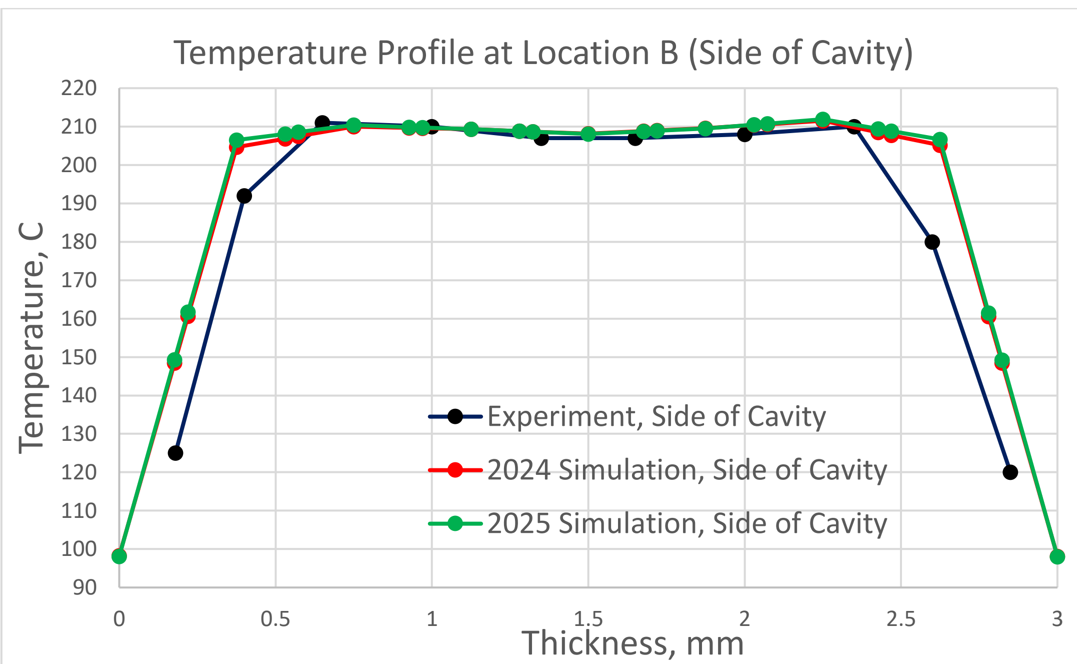

Figure 4: Comparison of measured and predicted temperature distributions at location B.

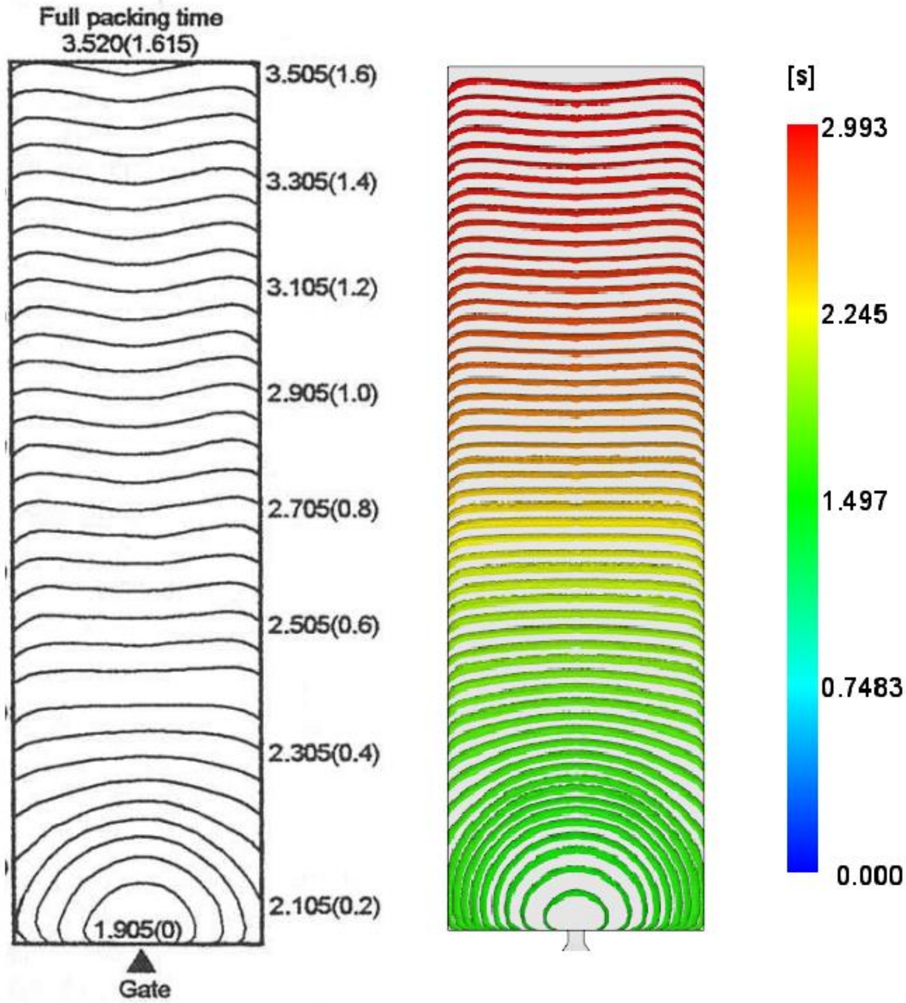

Figure 5: Comparison of filling pattern

Comparison with Dual Domain Flow analysis

The Moldflow 2025 3D Flow solver is expected to produce Flow Front Temperature (FFT) and injection pressure results which better match with the Dual Domain (DD) Flow analysis results. This is confirmed by the two cases shown below.

Grinder Head

The 3D mesh model of a “Grinder head” part is shown below in Figure 6. Polypropylene (Z6B09-10) was injected for injection time of 2 seconds, with melt and mold temperatures of 200 °C and 50 °C, respectively.

Flow Front Temperature (FFT) and pressure at V/P switch-over results from 3D Flow analyses of Moldflow 2024 and Moldflow 2025 releases as well as Moldflow 2025 DD Flow analysis are compared in Figures 7.a and 7.b. The range of predicted FFT from the Moldflow 2025 3D Flow analysis is narrower, which is in better agreement with the FFT result from DD Flow analysis. Consequently, the predicted pressure at V/P switch-over is lower and better matched the result from DD Flow analysis.

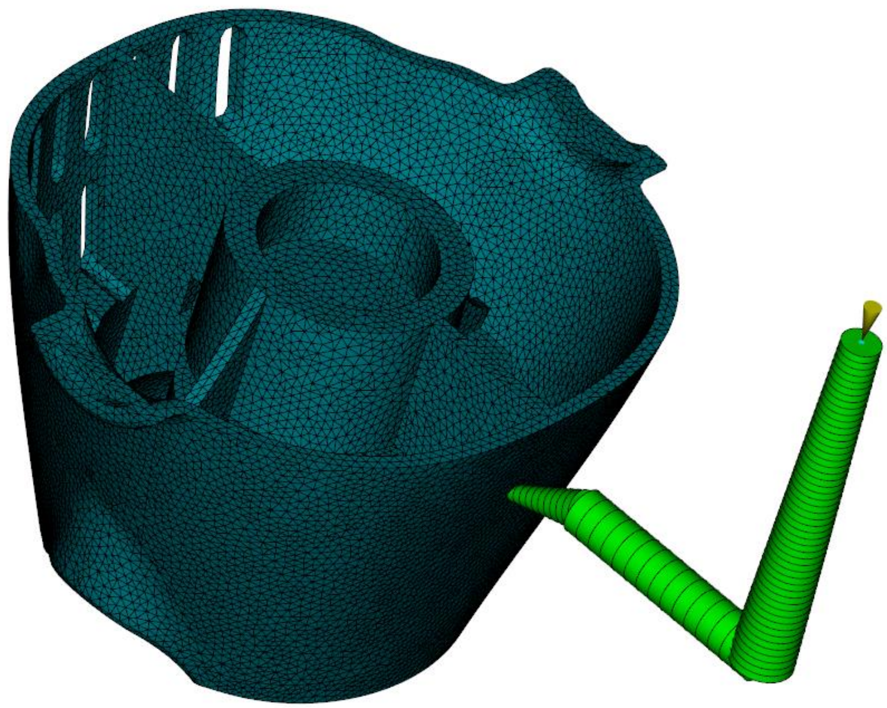

Figure 6: 3D Mesh model of part “Grinder head”

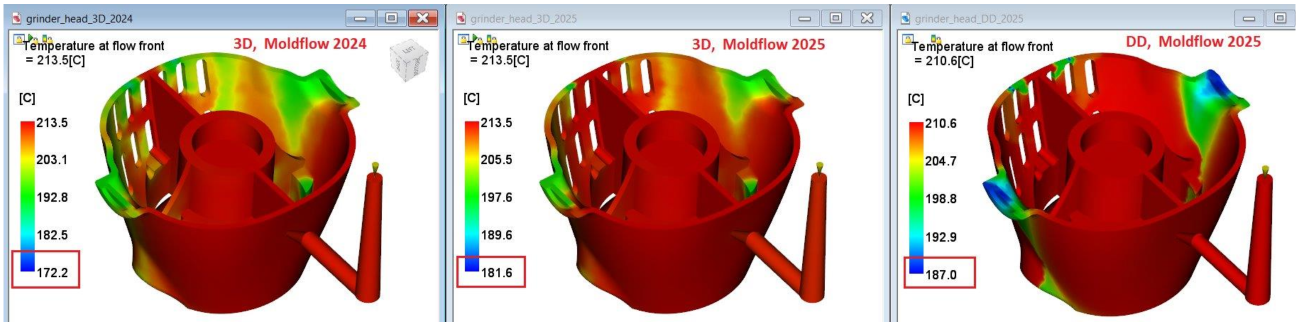

Figure 7.a: Comparison of Flow Front Temperature of 3D and Dual Doman Flow analyses

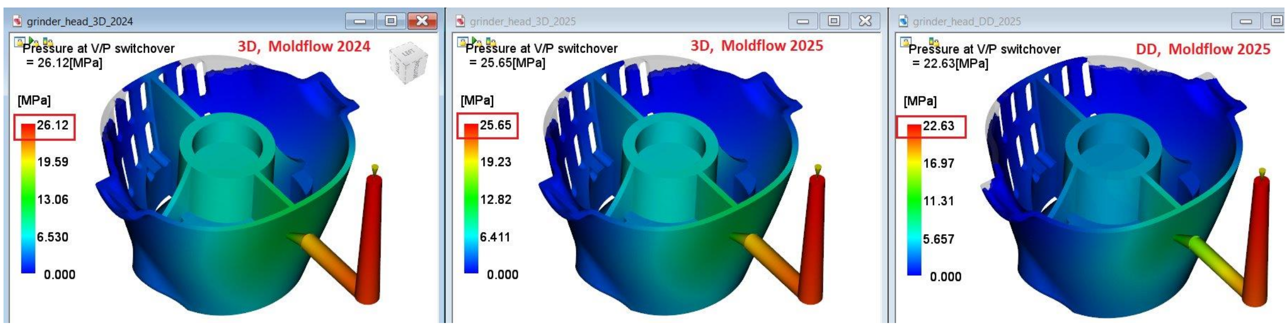

Figure 7.b: Comparison of Pressure at V/P switch-over of 3D and Dual Domain Flow analyses

Thin-Walled Tray

Filling analyses were also performed using a thin-walled tray model shown in Figure 8. This tray was molded using an unfilled PP polymer, Moplen EP301K, from LyondellBasell Australia. The molding is center gated from a cold sprue with a uniform wall section thickness of 0.8mm and overall part dimensions of 125 mm x 87 mm. The molding process included a constant flow rate of 30 cm^3/s and melt and mold temperatures of 220 °C and 40 °C, respectively.

Predicted Flow Front Temperature (FFT) and pressure at V/P switch-over from 3D Flow and DD Flow analyses are compared in Figures 9.a and 9.b. The predicted FFT from all analyses are similar within most of the cavity, but near the corners the FTT prediction from Moldflow 2025 3D Flow are in better agreement with the result from DD Flow analysis. Compared to the predicted pressure at V/P switch-over from Moldflow 2024 3D Flow analysis, the prediction from Moldflow 2025 3D Flow is lower because of higher temperature and more balanced filling. Both trends, higher FFT and more balanced filling near the end of flow, represent an improvement in consistency with the results from DD Flow analysis.

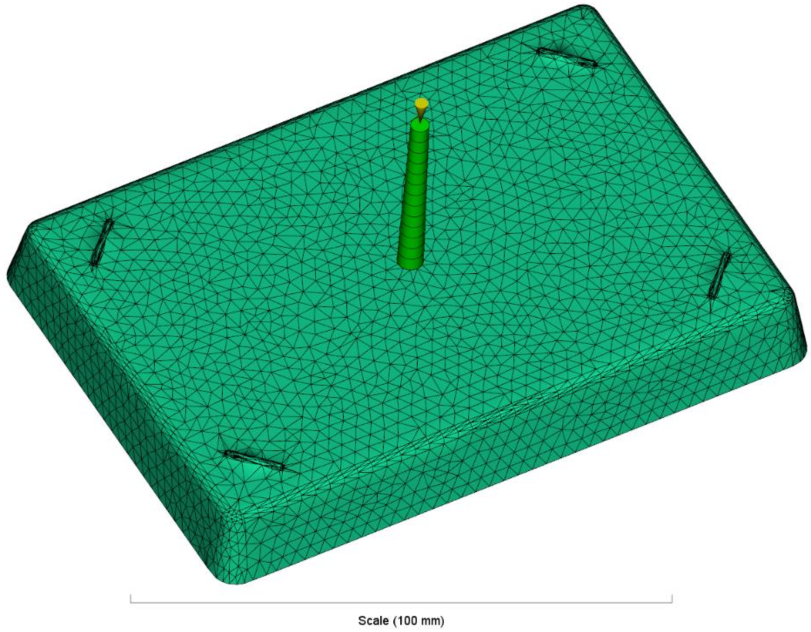

Figure 8: Center-gated tray model

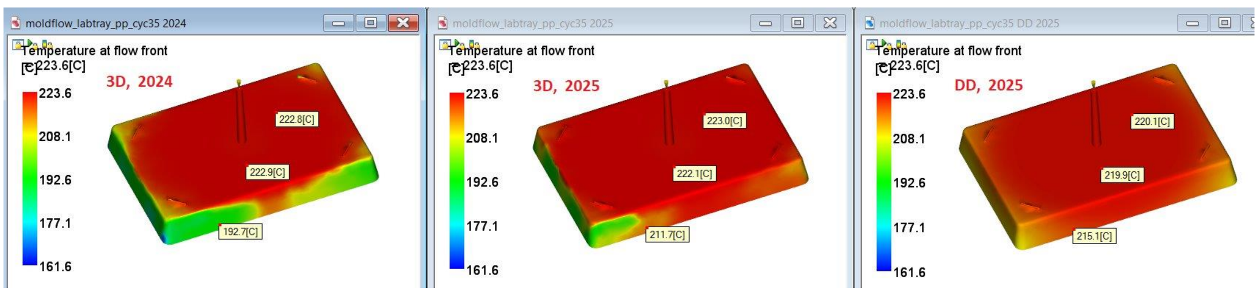

Figure 9.a: Comparison of Flow Front Temperature of 3D and DD Flow analyses

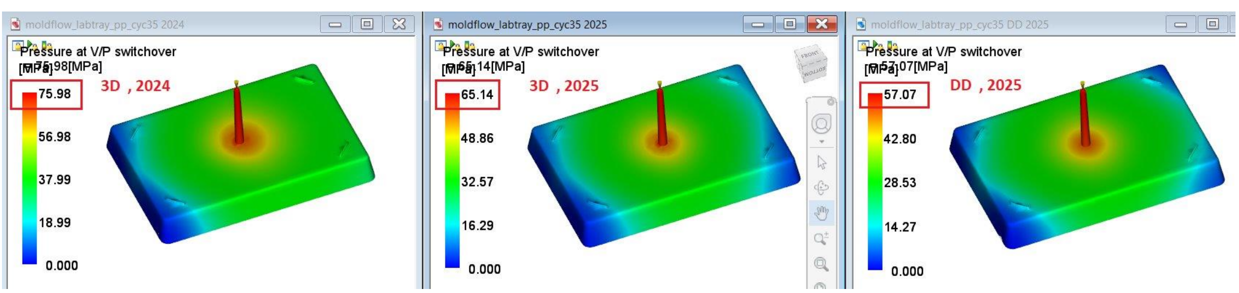

Figure 9.b: Comparison of Pressure at V/P switch-over of 3D and DD Flow analyses

3D Solver Speed Improvements

Various improvements to the software coding of the 3D Flow and 3D Warp calculation algorithms are included in the Moldflow 2025 release to reduce the computation time required for each analysis. The implementation improvements are not made at the expense of solution accuracy. In some cases, the computation speed improvements necessitate an increase in the memory usage of the analysis.

Methodology

A comprehensive suite of studies was analyzed in Autodesk Moldflow Insight 2024 and Autodesk Moldflow Insight 2025. The suite includes injection molding, compression molding, injection-compression molding, gas-assisted injection molding, overmolding, Microcellular injection molding, reactive molding, Resin Transfer Molding, and core shift analysis, utilizing unfilled and fiber-filled materials. To ensure consistent computational times, a fixed number of processor threads was employed. The analyses were submitted via the Simulation Compute Manager (SCM) to the local computer, with only one analysis running at a time.

The speedup is calculated as the ratio of the elapsed wall clock time in Moldflow 2024 to that in Moldflow 2025 for each sequence in every study, and the results are displayed in Figure 10. Each value is labeled with the study name followed by the analysis sequence step. For example, *study05:#2* refers to the second analysis in the analysis sequence of the study named *study05*. The Cool and Cool (FEM) analyses are excluded from the comparison because there are no speed-related changes in those solvers.

Speed Comparison Results

The results are grouped by solver executables. The speedup ranges from 1 up to 2.7 for the 3D Flow solver, and from 1.08 to 1.29 for the 3D Warp solver. On average, the speedup is 1.23 for the Flow solver and 1.16 for the Warp solver. A few analyses show a speedup greater than 1.2, including gas-assisted injection molding (study03:#1), compression overmolding (study05:#1), fiber analysis in a model with a large variation of element size and a large number of extremely small elements (study09:#1), and core shift analysis (study14:#1).

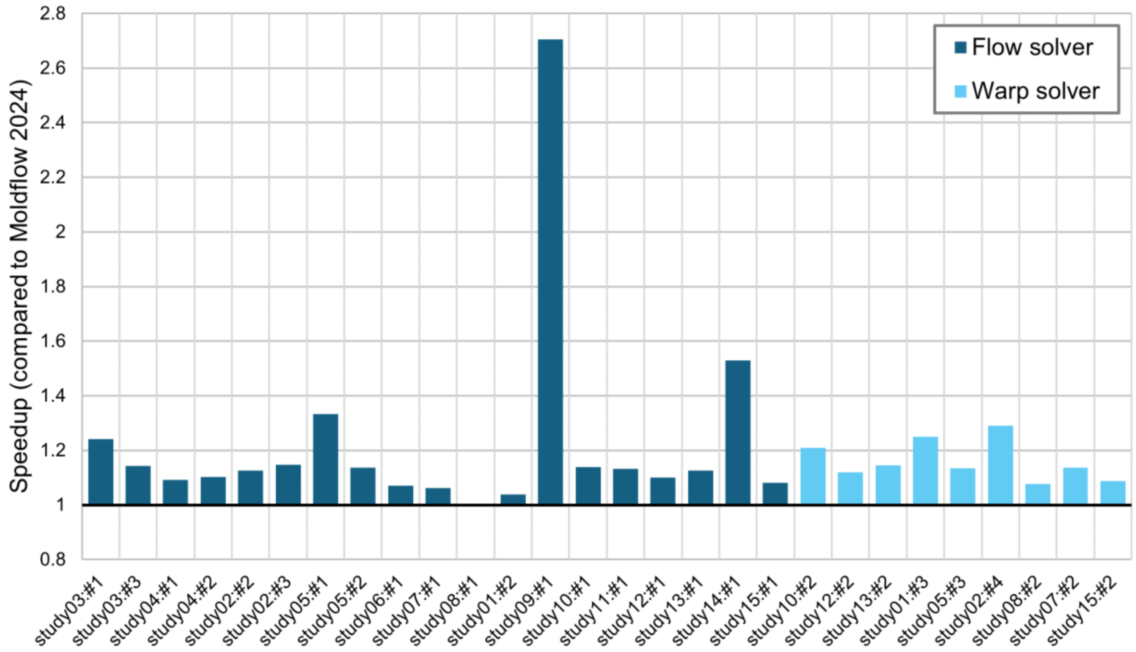

Figure 10. The speedup in Moldflow Insight 2025, compared to Moldflow Insight 2024.

Other Solver Improvements

In addition to the improved accuracy and speed of the 3D Flow and Warp solvers, other improvements are also included in the Moldflow 2025 release. These include:

- Velocity Controlled valve gates for 3D Flow analyses
- Cooling Channel Optimization
- Adoption of the Automatic Packing Profile as the default packing profile for most processes
- Enhanced information about the causes of warp deformation when constraints are present
- Improved flow rate calculation for Midplane and Dual Domain models with large hot runners
- Improved warp accuracy for Dual Domain Analyses
- Improved accuracy for Reactive Viscosity calculations for 3D models
- Option of a press opening phase during 3D injection-compression molding

These improvements are explained in greater detail in the What's New section of the Moldflow Insight 2025 online help:

https://help.autodesk.com/view/MFIA/2025/ENU/?guid=MFLO-WHATS-NEW-2025-0

References

1. Y. Murata, S. Abe, and H. Yokoi, "Experimental Analysis of Faster Advance of Flow-Front at Both Sides of Cavity Than Center", *Asian Workshop on Polymer Processing in Singapore 2002, April 4 – 6* (2002).