

Autodesk® Simulation Moldflow® Insight 2013

What's New in this Release

The Autodesk logo is displayed vertically in white text on a black rectangular background. The word "Autodesk" is written in a sans-serif font, with a registered trademark symbol (®) at the top right of the letter "k".

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Autodesk® Simulation Moldflow® Insight

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Release notes

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New features and enhancements are introduced to improve interoperability among Autodesk products, expand the range of simulation capabilities, enhance solution accuracy and reduce time to solution.

What's new

New features and enhancements implemented in this product are summarized.

License prerequisites

The Autodesk Simulation Moldflow Synergy - User Interface and Autodesk Simulation Moldflow Insight - Solvers applications are licensed and installed separately. To complete the product installation, you must install both applications. Before you run the product for the first time, you must have installed and be able to access the Autodesk Network License Manager.

ATTENTION: You must have a valid 2013 serial number and product key for both the user interface and solvers applications, and you must register your products and activate your licenses in order to use the product.

Refer to the *Autodesk Simulation Moldflow Insight 2013 Installation Guide* for detailed instructions.

Autodesk Vault integration

The ability to integrate with Autodesk Vault data management software products is now available at no cost for Autodesk Simulation Moldflow Adviser and Autodesk Simulation Moldflow Insight products. Autodesk Vault products organize, manage, and track data creation, simulation, and documentation processes for design and engineering workgroups.

Using Autodesk Vault products allows you to securely store and manage data in a central location, helping teams quickly create, share, and reuse digital prototyping information. With this integration, together with compatible installations of Vault Client and Vault Server, you can access basic file management functionality within the Autodesk Simulation Moldflow environment for a project and its associated files.

This functionality includes the following features:

- Version control of the Autodesk Simulation Moldflow project and associated files.
- Access and data management using a centralized model repository.
- A living history of the project.
- File sharing for each team member.
- The ability to refresh the local copy of a file, which ensures all team members are working on the latest version of the project.

RESTRICTION: The **Autodesk Vault** tab will not appear in the Autodesk Simulation Moldflow product user interface unless the Vault Client is installed on the local machine. To take advantage of the functionality, you also must have access to a Vault Server installation on either the network or the local machine.

IMPORTANT: The Autodesk Simulation Moldflow product(s) must be installed *before* the Vault Client is installed.

NOTE: The **Vault Client** installer is included in a separate folder on the installation media of the Autodesk Simulation Moldflow Adviser and Autodesk Simulation Moldflow Synergy - User Interface products.

The **Vault Server** installer is included on a separate DVD in the Autodesk Simulation Moldflow Adviser and Autodesk Simulation Moldflow Synergy - User Interface product boxes.

Autodesk Vault products also can be downloaded separately.

Improved Autodesk Inventor Fusion software available

Autodesk Inventor Fusion software is a fully fledged, history-free CAD modeler that is included at no additional cost with the Autodesk Simulation Moldflow Adviser and Autodesk Simulation Moldflow Insight products. The Autodesk Inventor Fusion product now allows you to modify part geometry even more efficiently, regardless of the CAD system in which it was created or the existence of parametric relationships in the model.

Autodesk Inventor Fusion 2013 software is included in the installer and by default is selected for installation when either Autodesk Simulation Moldflow Adviser or Autodesk Simulation Moldflow Synergy - User Interface is installed. It also can be downloaded separately.

Additional license-free CAD formats available for import

Autodesk Simulation Moldflow Insight, Autodesk Simulation Moldflow Adviser, and Autodesk Simulation Moldflow CAD Doctor products now can import Autodesk Inventor, Autodesk Alias, and SAT files, without having to install an additional product or requiring an additional license.

This license-free capability also enables the import of files in IGES and STEP formats.

Consolidated Autodesk Simulation Moldflow Design Link available

Additional CAD import formats are available through a newly consolidated, licensed version of Autodesk Simulation Moldflow Design Link.

Once installed with the required license, this new version enables the direct import of Parasolid, SolidWorks, Pro/ENGINEER, CATIA V4 and V5, NX, and Rhino files.

Autodesk Simulation Moldflow CAD Doctor update

A solid CAD model which has been read into Autodesk Simulation Moldflow CAD Doctor can now be exported as a solid model included in a Study (*.sdy) file. These Study files then can be imported into Autodesk Simulation Moldflow Insight or Autodesk Simulation Moldflow Adviser.

Part geometry as well as assembly information is retained in these Study files. Because these Study files contain solid models with geometry in CAD format, the quality of the mesh that will be generated for these models in Autodesk Simulation Moldflow Insight will be significantly improved. You also can take advantage of the **Modify with Autodesk Inventor Fusion** tool if the CAD model requires additional modification.

Improved user interface efficiency

Enhancements have been implemented to significantly improve the performance of the graphical user interface.

Improved Dual Domain meshing speed	Improvements to the mesher have resulted in much faster mesh generation, particularly for Dual Domain models.
Improved model load speed	Open, Import and Save operations now complete up to seven times faster. This is particularly noticeable for large models.
Improved model interaction speed	Selection and Layer operations are now faster and use less memory, making interactions with the model more efficient, particularly for large models.
Improved post-processing speed	Post-processing tasks, including result animation, have been optimized for large models.

Crystallization analysis option for Midplane and Dual Domain analyses of Thermoplastics Injection Molding applications

An option to perform Crystallization analysis has been implemented for analyses of the Thermoplastics Injection Molding process using Midplane and Dual Domain analysis technology. Modeling the flow-induced crystallization and morphological changes of semi-crystalline materials can

improve the accuracy of prediction of cavity pressure decay and the mechanical properties of the molded parts, and subsequent shrinkage and warpage predictions.

In addition to the thermal effect on the crystallization process, Crystallization analysis accounts for the effects of flow on crystallization of the material by relating excess free energy and flow-induced orientation to crystallization kinetics.¹ In turn, the crystallization of the material influences the flow analysis, including changes in the modeling of viscosity, p_vT , solidification, the inclusion of latent heat in the energy equation, and the orientation effect on shrinkage.

The effect on the predicted mechanical properties (including orientation) then influences subsequent shrinkage (and therefore, warpage) predictions.

The option to perform Crystallization analysis is available for Thermoplastics Injection Molding processes when an analysis sequence that includes Fill is selected.

In addition, the material selected for the analysis must be a semi-crystalline material for which the crystallization morphology parameters are included in the material data. The Thermoplastics material database has been updated to include generic crystallization morphology data for all grades in the 10 most commonly used families of non-fiber-filled, semi-crystalline materials and 10 of the most commonly used families of fiber-filled, semi-crystalline materials. This data is displayed on the **Crystallization Morphology** tab of the **Thermoplastics material** dialog.

Results specific to Crystallization analysis include **Crystallization: Crystalline orientation factor**, **Crystallization: Relative crystallinity**, **Crystallization: Average relative crystallinity**, elastic modulus including crystallization effects in the first and second principle directions (**Crystallization: Mechanical properties E11** and **Crystallization: Mechanical properties E22**), and **Crystallization: Final relative crystallinity**.

NOTE: The option to perform Crystallization analysis is off by default. To perform a Crystallization analysis, ensure that you have selected a semi-crystalline material with crystallization morphology data, select an analysis sequence that includes Fill+Pack, and select the **Crystallization analysis (requires material data)** option in the **Process Settings Wizard**.

Transient Cool (FEM) solver enhanced to support Dual Domain models and additional molding processes

The transient mold temperature analysis options have been expanded to include the Reactive Molding and Microchip Encapsulation processes for 3D analysis technology. Support for Dual Domain models is now also included for the Thermoplastics Injection Molding process. For those

¹ This Flow-Induced Crystallization model is the subject of a United States Patent application (R. Zheng, P.K. Kennedy, and R.I. Tanner), and Autodesk holds an exclusive license for use of this model.

systems with an installed CUDA-enabled GPU (Graphics Processing Unit) card capable of double precision computations, the software will now automatically use it to improve the analysis time.

The transient mold temperature analysis options enable you to see how the mold temperature varies with time. The Cool (FEM) solver uses the finite element method to calculate results, using a 3D finite element mesh for the mold.

There are three different **Mold temperature options** which can be selected for the Cool (FEM) analysis sequence.

Transient within cycle	The Transient within cycle analysis option can simulate the cyclical nature of the mold temperature within a cycle and enables you to see the deviations from the cycle-averaged mean temperature.
Transient from production start-up	The Transient from production start-up analysis option will show the evolution of temperature cycles until the mold reaches a stable temperature cycle.
Averaged within cycle	While not a transient analysis, the Averaged within cycle analysis option uses the Cool (FEM) solver to determine the average mold temperature during the molding cycle for each location in the mold. This solution is the default selection, and it is equivalent to the existing boundary element method (BEM) Cool analysis sequence.

In a Cool (FEM) analysis sequence for 3D analysis technology, part temperatures and the heat flux from the part into the mold can be determined by either of two finite element method solver options, which are specified in the **Cool (FEM) Solver Parameters**. For Dual Domain analysis technology, only the **Conduction solver** is available.

- As with the boundary element solution used in the Cool analysis sequence, the **Conduction solver** in the Cool (FEM) analysis considers only the thermal effect of melt contained in the molding cavity and ignores shear heating and fill pattern effects. The conduction solver therefore provides similar information to the boundary element solver used for Cool analyses, but, in most cases, requires less computation time than the boundary element solver. This is the default selection.
- The **Flow analysis on every iteration** option can be used to capture the shear heating and fill pattern effects from flow, but takes longer to run than the conduction solver.

3D Mold Mesh tool now supports Dual Domain models

The Cool (FEM) analysis sequence requires that the mold be represented by a 3D tetrahedral mesh for both 3D and Dual Domain models. You can choose to import mold geometry from a CAD model or STL model, create mold surfaces directly, or use the **Mold Surface Wizard** to generate an initial mold surface. After the mold geometry has been added to the model, use the **3D Mold Mesh** tool to generate the required mesh.

NOTE: You must select an analysis sequence that includes Cool (FEM) before you use the **3D Mold Mesh** tool to generate the mold mesh.

Simulate rapid mold heating and cooling

At higher mold temperatures, the surface quality of the part improves, but the time required to cool the part will increase, resulting in an increased cycle time. Rapid mold heating and cooling is a technique that is used to improve the surface quality of a part, while keeping the cycle time as short as possible. Since the mold temperature varies throughout the cycle, the simulation of this process is achieved using the transient Cool (FEM) solver.

The mold rapid heating and cooling feature enables you to simulate the use of channels which first heat and then cool the mold, using either saturated steam or hot water for the heating process and cold water for the cooling process. The **Process Settings Wizard** is still used to define the injection molding cycle; the mold rapid heating and cooling cycle is set independently on the cooling channels but must take into account the timings set in the **Process Settings Wizard**.

The rapid heating and cooling feature is highly flexible, enabling you to program the simulation to reflect your system as closely as possible. For example, you can define whether to heat the mold when it is open or closed, to delay heating where appropriate, or to define steam-heating by pressure or temperature.

Cartridge heater enhancements

The 1D cartridge heater element property specification has been expanded to include additional control features: **Time**, **Time with Target Temperature**, and **Thermocouple**.

The **Time** and **Time with Target Temperature** controls enable you to program the cartridge heaters in such a way as to simulate mold rapid heating and cooling using cartridge heaters as the heat source. The **Process Settings Wizard** is still used to define the injection molding cycle; the cartridge heating cycle is set independently but must take into account the timings set in the **Process Settings Wizard**.

Using the **Time with Target Temperature** option, the cartridges can be programmed to heat while the mold is open or closed.

Stitch Contact Interfaces tool for meshing molds with inserts or cores

Transient cool analyses require the creation of a 3D mold mesh. If your model does not include a mold, you can model one using the **Mold Surface Wizard**. The 3D mold meshing process has been expanded to enable meshing of molds that have been created by the **Mold Surface Wizard**, which can include part inserts, mold inserts or cores.

In order to prevent the creation of slivers of mold at the contact surfaces between the part and any inserts or cores, a new **Stitch Contact Interfaces** tool has been developed which creates mold internal triangles on the

boundaries of each mold internal component. These new mold internal triangles are then stitched together to create a surface that envelopes the part and insert/core components cleanly, without ambiguity at the interfaces.

The stitched surface will then be used in the generation of the mold mesh in the usual manner, using the **3D Mold Mesh** tool; the first pass creates the 2D mold surface mesh and the second pass creates the 3D mold mesh.

Fiber breakage calculation option available for analyses of long-fiber filled thermoplastic materials

The option to **Calculate fiber breakage** is now available when performing a Fiber orientation analysis if the selected material is a long-fiber filled composite.

The fiber breakage calculation accounts for the breakage of long fibers that occurs in the feed system and cavity during the molding process. A material is considered to be a long-fiber composite if the initial fiber length is at least 1 mm. Results produced when the fiber breakage calculation is enabled include **Fiber length averaged by number**, **Fiber length averaged by weight**, and **Fiber length probability distribution**.

The option to perform **Fiber orientation analysis if fiber material** is on by default. To enable the fiber breakage calculation, ensure that you have selected a long-fiber filled material from the **Thermoplastics material** database, and select an analysis sequence that includes Fill+Pack. From the **Process Settings Wizard**, access the **Fiber Solver Parameters**, and set the **Calculate fiber breakage** option to **Yes**. To view or edit parameters specific to the fiber breakage calculation, click **Fiber breakage parameters**.

NOTE:

- The fiber breakage calculation is not supported for thermoset molding processes.
 - The current implementation does not consider fiber breakage that occurs in the barrel during plastification.
 - The Warp analysis does not fully account for the effects of long fiber breakage on the predicted mechanical properties distribution.
-

Fiber orientation analysis option extended to 3D analyses using thermoset composite materials

The option to perform **Fiber orientation analysis if fiber material** has been implemented for analyses of Reactive Molding and Microchip Encapsulation processes using 3D analysis technology. This enables the same fiber orientation model options that were previously implemented for 3D analyses of thermoplastics molding processes.

Including fiber orientation results can improve predictions of process-induced mechanical properties and subsequent shrinkage and

warpage predictions for the supported thermoset molding processes. Results specific to fiber orientation analysis include fiber orientation tensor, coefficients of thermal expansion, Poisson's ratio, shear modulus, and tensile modulus.

The option to perform **Fiber orientation analysis if fiber material** is on by default. To perform a Fiber orientation analysis, ensure that you have selected a fiber filled material from the **Thermoset material** database, and select an analysis sequence that includes Fill+Pack. To disable this option, deselect the checkbox on the first page of the **Process Settings Wizard**.

To view or change the model used to calculate fiber orientation in the current study, access the **Calculate fiber orientation using** option in the **Fiber Solver Parameters** dialog. To view or change the default settings, access the **Fiber Analysis** tab of the **Reactive Molding Solver Parameters (3D)** dialog. Options for calculating fiber orientation in 3D analyses include:

- Folgar-Tucker model with auto-calculated C_i (the default selection)
- Folgar-Tucker model with specified C_i
- RSC or ARD-RSC model (determined by length)
- RSC model with specified C_i

NOTE: Fiber orientation analysis is not supported for the Underfill Encapsulation molding process.

3D Microchip Encapsulation improvements for Wire Sweep and Paddle Shift analyses

For Wire Sweep analyses of Microchip Encapsulation processes using 3D analysis technology, it is now possible to assign multiple wire material properties in the same model to better represent actual wire types used in manufacturing. In addition, new analysis sequences combining Paddle Shift (or Dynamic Paddle Shift) with Wire Sweep in the same sequence are available.

Assign multiple wire material properties in the same model

When you select a wire material from the Wire material database, the properties associated with that wire material are included in the default process settings. Previously, all wires in the model had to share the properties of the single selected wire material. Now it is possible to edit the properties assigned to an individual wire or group of wires in the model, and the analysis will account for the different wire material property sets when the wire sweep calculation is performed.

To apply more than one set of wire material properties on a model, select one or more wires you want to modify, right-click and select **Properties** to

² The fiber aspect ratio must be greater than 1. The aspect ratio is reported on the **Filler Properties** tab of the **Thermoset material** details dialog.

display the **Wire** dialog. Change the **Wire material option** to **Specified**, specify the new set of property values, type a name for the new property set in the **Name** text box, and click **OK** to apply the new properties to the selected wires. Wire properties associated with the wire material specified in the process settings remain unchanged.

New analysis sequences combine Wire Sweep and Paddle Shift analyses

Previously, Wire Sweep and Paddle Shift analyses were available in separate analysis sequences (for example, **Fill+Pack+Wire Sweep** or **Fill+Pack+Paddle Shift**). The new analysis sequences combine the Paddle Shift (or Dynamic Paddle Shift) and Wire Sweep analyses sequentially, which effectively eliminates repetition of the Fill+Pack analysis and reduces time to solution significantly.

Examples of new analysis sequences include:

- **Fill+Pack+Paddle Shift+Wire Sweep**
- **Fill+Pack+Dynamic Paddle Shift+Wire Sweep**

NOTE: The new analysis sequences only include regular Wire Sweep analysis. Wire Sweep Detail analysis is not available in a combined analysis sequence. The new analysis sequences are provided in addition to the original, separate analysis sequences.

Solver enhancements address accuracy and speed

Enhancements have been implemented to improve the performance of analysis solvers.

Parallel solution technology improves time to solution for Midplane and Dual Domain models

The use of parallel solution technology to improve time to solution has been extended to Fill and Fill+Pack analyses of Midplane and Dual Domain, thermoplastics molding processes. The new **Number of threads for parallelization** option is included in the **Thermoplastics injection molding solver parameters** and is set to **Automatic** by default.

Previously, parallel solution technology was implemented only in 3D analysis solvers.

Automatic parallelization enables the solver to read the CPU usage at each time step and assign an appropriate number of threads to use at that time step of the analysis. Therefore, the number of threads used in the analysis may vary if the machine load (CPU usage) varies during the analysis.

The primary advantage of automatic parallelization is efficiency. The solver looks for physical cores when it determines the most efficient number of threads to use during the analysis; this prevents machine overload and takes advantage of speed improvements where available.

To view or edit the parallelization setting, in the **Process Settings Wizard**, click **Advanced options**; in the **Solver parameters** group, click **Edit**; then click the **Parallelization** tab to display the **Number of threads for parallelization** setting. Options are:

- **Automatic** (this is the default setting)
- **Single thread (No parallelization)**
- **Maximum**
- **Specify number of threads**

NOTE: Running multiple simultaneous analyses where automatic parallelization is used may not always result in a faster analysis time. This is due to resources being shared between parallel tasks.

OpenCL support for 3D analysis solvers

Use of GPU (graphics processing unit) technology to reduce solution time for 3D analyses is expanded to include graphics cards with OpenCL support, in addition to the previously supported NVIDIA CUDA graphics cards.

OpenCL is now supported by all analyses that support use of GPU technology.

A GPU is used for the analysis automatically if a compatible graphics card is available on the computer and an option to use a GPU is selected. The graphics card must be capable of double-precision computations.

NOTE: On computers where the graphics card supports both CUDA and OpenCL, the analysis will use CUDA technology preferentially.

Improved 3D automatic injection time

Often the automatic injection time calculated for a chunky 3D model has been too long. The algorithms used for this calculation have been modified to produce a more realistic result.

The automatic injection times for thin-walled parts remain unchanged.

Improved 3D weld line prediction

In response to customer feedback, the calculation of weld lines in 3D analyses has been improved. The new method incorporates a larger search area around the flow front and detects weld lines that previously were not detected.

This broader area of investigation has the dual effect of detecting smaller weld lines and improving the accuracy of existing weld lines.

Material database changes

Changes to the material database that have been implemented since the release of Autodesk Moldflow 2012, Service Pack 1, are summarized here.

These changes accommodate new data required to support solver changes implemented in this product, as well as new information received from material suppliers.

Details of these changes are found in the *Material Database Changes* document provided separately.

Changes to the Thermoplastics material database

- Total number of suppliers: 451
 - New suppliers added: 19
 - Suppliers deleted: 13
- Total number of grades: 8720
 - Grades added: 703
 - Grades deleted: 671
 - Grades amended: 4614
- Specific data:
 - Grades with specific PVT data: 5307
 - Grades with long-fiber Filler Initial Length data: 25
 - Grades with specific Crystallization Morphology data: 19
 - Grades with default Shrinkage Properties data: 2022
 - Grades with Crystallization - Residual Stress data: 1127
 - Grades with Crystallization - Residual Strain data: 1165
 - Grades with RSC or ARD-RSC Fiber - Residual Stress data: 702
 - Grades with RSC or ARD-RSC Fiber - Residual Strain data: 751
 - Grades with RSC/ARD-RSC and Crystallization - Residual Stress data: 490
 - Grades with RSC/ARD-RSC and Crystallization - Residual Strain data: 510

Changes to the Thermoset material database

- Total number of suppliers: 46
 - New suppliers added: 2
- Total number of grades: 190
 - Grades added: 5

Autodesk Simulation Moldflow Communicator compatibility

Please use Autodesk Simulation Moldflow Communicator 2013 to view Moldflow Results files (*.mfr) exported from Autodesk Simulation Moldflow Insight 2013.

The Autodesk Simulation Moldflow Communicator results viewer is included in the installer and by default is selected for installation when either Autodesk Simulation Moldflow Adviser or Autodesk Simulation Moldflow Synergy - User Interface is installed. It also can be downloaded separately.