Autodesk® Moldflow® Insight 2012

AMI Process Optimization Analysis

Autodesk®

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Contents

Process Optimization analysis 1

Process Optimization analyses are used to determine optimum ram speed and packing pressure profiles so that parts produced are of the highest quality.

The Process Optimization analysis calculates the optimum process settings, based on the material data, mold geometry, and molding machine characteristics. It then runs a Fill or a Fill+Pack analysis using the optimum process settings.

Process Optimization analysis capabilities

Given a mold, a machine and a material, the Process Optimization program aims to find the optimum process settings, through several iterations, so that the resulting parts do not warp, contain sink marks or have any weaknesses associated with injection molding. These process settings can be directly implemented on the molding machine.

Process Optimization analysis output

The Process Optimization analysis calculates:

- A ram speed profile that slows down at narrow cross sections and speeds up at larger cross sections. The machine response is taken into account as the inertia is significant. Variations in the flow front melt temperature are minimized to reduce surface defects and warpage.
- A packing pressure profile that minimizes the variation in shrinkage across the part, thus reducing warpage and increasing the ability to produce a part with a high dimensional accuracy.

A new study containing a Fill or Fill+Pack analysis, which was run with the optimum ram speed profile and packing profile, is provided at the end of a Process Optimization analysis.

Process Optimization analysis

Process Optimization analyses are used to determine optimum ram speed and packing pressure profiles, so that the parts are produced are of the highest quality.

Setting up a Process Optimization analysis

The following table summarizes the setup tasks required to prepare a Process Optimization analysis of a non fiber-filled, or fiber-filled thermoplastic material.

Setup task	Analysis technology
Molding processes	
Feed system	
Meshing the model	
Mesh orientation diagnostic	
Analysis sequence	
Selecting a material	
Injection locations	
Process settings	
Injection molding machine characteristics and Process Optimization analysis on page 6[1]	

Optional setup tasks

Setup task	Supported for analysis technology
Cavity/core side mold temperatures[2]	

Process Optimization analysis

Use this dialog to specify settings for a Process Optimization analysis.

Process Settings Wizard dialog—Optim Settings

This page of the **Process Settings Wizard**, which can be accessed by clicking  (**Home tab > Molding Process Setup panel > Process Settings**), is used to specify the Process Optimization related process settings for the analysis sequence.

NOTE: Some of the items listed below may not be available on the current dialog. This is dependent on the mesh type, molding process and analysis sequence selected.

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[1] The **Process Settings Wizard** allows you to select and edit injection molding machine characteristics to match the particular characteristics of your molding machine.

[2] Manual core/cavity mold temperature assignment is only relevant when not performing Cool analysis.

Relative weightings for quality criteria (Dialog item)	Specifies the relative weightings, or importance, of part warpage, dimension stability and sink marks during a Process Optimization analysis.
Advanced options...	Displays the advanced options for the analysis.

Process Optimization Advanced Options dialog

This dialog is used to specify the solver settings for an Optim Process Optimization analysis. This option is only available for a Midplane or Dual Domain mesh.

To access this dialog, ensure that you have selected the molding process Thermoplastics Injection Molding and the analysis sequence Process Optimization (Fill) or Process Optimization (Fill+Pack), click  (**Home tab > Molding Process Setup panel > Process Settings**), click **Next** to navigate to the **Optim Settings** page of the Wizard, then click **Advanced options**.

NOTE: All solver settings have default, preset values that will be suitable for most analyses.

Machine stroke	Specifies the machine stroke to be used in the Optim simulation.
Machine minimum melt cushion	Specifies the minimum cushion, that is, the distance between the forward screw position and the zero screw position, that should be present at all times.
Machine response time factor	Optim only creates a profile step if a specified multiple of the machine hydraulic response time value for the selected molding machine has elapsed since the last step. The purpose of this option is therefore to smooth the velocity profile and avoid oscillatory behavior that may set in if the profile is allowed to change at inappropriately small intervals. For example, if the machine hydraulic response time is 0.01 sec and you specify a machine response time factor of 4, then each profile step must have a duration of at least 0.04 sec.
Velocity phase pressure limit	Specifies the maximum allowed pressure during the filling (velocity) phase.

Velocity phase flow rate limits	Specifies the minimum and maximum allowed flow rate values, as a percentage of the machine's maximum velocity capability, during filling.

Preparing the model for Process Optimization analysis

2

This topic provides you with the modeling tasks for a profile optimization analysis.

Compulsory modeling tasks

In order to run an optimum profile analysis, the following must be specified for your model:

- A meshed part model (can be either Midplane or Dual Domain mesh).
- A runner system.
- Injection location assigned at the top of the runner system.

Injection molding machine characteristics and Process Optimization analysis

3

Process Optimization analysis requires as input the characteristics of the specific injection molding machine that will be used to mold the part, including various information on the operating capacity and other physical and operational parameters of the injection molding machine.

This topic describes the specific injection molding machine characteristics required by the Process Optimization analysis and some advice on how to obtain this machine data.

Injection molding machine specification

The Process Optimization analysis calculates the optimum processing parameters based on the material data, mold geometry, and molding machine characteristics. The results of the Process Optimization analysis are based upon information that you supply about your injection molding machine.

Since the Process Optimization analysis optimizes the process for a given machine, you must specify how that injection molding machine works. You can select one of the machines from the supplied injection molding machine database and, if necessary, modify the data to suit your particular machine, or define your own injection molding machine that is then saved in the database.

Information required includes:

- Identification of machine
- Injection unit information
- Screw information
- Clamp unit information
- Controller information

Guidelines

Much of the molding machine data required by the Process Optimization analysis is available directly from the machine manufacturer's data sheet, such as:

- Screw diameter
- Maximum injection pressure
- Maximum clamp force
- Maximum number of velocity steps
- Maximum stroke.

It is recommend that the following critical parameters be verified experimentally, for maximum accuracy:

- Maximum injection velocity
- Machine response time

CAUTION: Appropriate safety procedures should be adhered to during these experimental tests.

Injection molding machine characteristics and Process Optimization analysis

Process Optimization analysis requires as input the characteristics of the specific injection molding machine that will be used to mold the part, including various information on the operating capacity and other physical and operational parameters of the injection molding machine.

Editing injection molding machine characteristics

The Optim Process Optimization analysis requires detailed specification data from your injection molding machine.

Use the procedure described below to create a molding machine characteristics specification or to edit an existing specification.

1. Look up the **IMM specifications** for your particular machine.
2. Click **Home tab > Molding Process Setup panel > Process Settings**, or double-click the Process Settings icon in the **Study Tasks** pane.
3. Click **Advanced options...** in the **Fill+Pack** or **Fill settings** page of the Wizard.
4. Select a previously used injection molding machine from the **Injection Molding Machine** drop-down list, or, click **Select** to select one from the supplied database, and then click **Edit**.

   If none of the existing entries in the database are suitable, then select the **Default molding machine** entry.
5. Enter the required injection molding machine data into the **Injection Molding Machine** dialog.
6. If you want to save this data in the database under a new name, enter the new name in the **Name** box.
7. Click **OK** twice to save the molding machine characteristics data that you have entered.

Injection molding machine characteristics and Process Optimization analysis

Use these dialogs to control the relative weights of quality criteria among warpage, dimensional ability and sink marks.

Process Optimization process settings dialog—Fill Analysis tab

The **Fill Analysis** tab of the **Process Optimization process settings defaults** dialog is used to specify default values for the analysis inputs for a **Process Optimization (Fill)** analysis sequence.

NOTE: The values used for the current analysis sequence may be changed by entering the desired values on the Process Settings Wizard—Optim Settings dialog.

Relative weightings for quality criteria	Allows you to specify the relative weightings, or importance, of part warpage, dimension stability and sink marks during a Process Optimization analysis.

Process Optimization process settings dialog—Fill+Pack Analysis tab

The **Fill + Pack Analysis** tab of the **Process Optimization process settings defaults** dialog is used to specify default values for the analysis inputs for a **Process Optimization (Fill + Pack)** analysis sequence.

NOTE: The values used for the current analysis sequence may be changed by entering the desired values on the Process Settings Wizard—Optim Settings dialog.

Relative weightings for quality criteria	Allows you to specify the relative weightings, or importance, of part warpage, dimension stability and sink marks during a Process Optimization analysis.