Autodesk® Moldflow® Insight 2012

AMI Shrink Analysis Results

Autodesk®

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Shrink analysis results 1

This help topic specifies the results for a Shrink analysis on a thermoplastic material.

Text based results

The following table lists the text results generated for a Shrink analysis.

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Results Summary
Analysis Check

Graphical results

The following table lists the results generated for a Shrink analysis, and indicates whether each result is supported for the following analysis technologies:

- Midplane
- Dual Domain

For more information about a result, including how to interpret the display, click on the result name.

Result	Analysis technology
Shrinkage check plot result on page 10	
Predicted error result on page 7	
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Average linear shrinkage result

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The Average linear shrinkage result is the equally-weighted average of the parallel shrinkage and the perpendicular shrinkage results.

Using this result

Use this result to obtain a single-figure result indicating the shrinkage within a part. Warping effects, where the difference in parallel and perpendicular shrinkage is high, will not be visible using this result.

Things to look for

Look for regions in which there is high differential shrinkage. These regions are more likely to deform.

Error in average linear shrinkage result

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The Error in average linear shrinkage result is the equally-weighted average of the parallel shrinkage and the perpendicular shrinkage results, expressed as a difference from the average linear shrinkage value for the entire part.

Using this result

Use this result to obtain a single-figure result indicating the shrinkage within a part. Warping effects, where the difference in parallel and perpendicular shrinkage is high, will not be visible using this result.

Things to look for

Look for regions in which there is high differential shrinkage. These regions are more likely to deform.

Error in (X, Y, Z) component of shrinkage result

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The Error in X, Y or Z component of shrinkage result indicate the percentage of shrinkage that occurs in the part in the direction of the X, Y and Z axes, respectively, as a difference from the average shrinkage in that direction.

A part which is oriented perpendicular to an axis will show negative error in shrinkage in that axis' direction.

Using this result

Use this result to see which parts of your model shrink more or less than average. Results closer to zero indicate places where the model has shrunk evenly and will therefore maintain its shape.

Things to look for

Look for regions where high differential shrinkage exist. These regions are more likely to deform.

Parallel shrinkage result 5

The Parallel shrinkage result indicates the percentage of shrinkage in each element in the local orientation direction, before warpage is calculated.

The local orientation direction is the direction of fiber orientation for fiber-filled materials and the direction of material orientation (flow direction before freezing) for all other materials.

This result is produced by a Shrink analysis based on predicted shrinkages from the specified material shrinkage model (residual stress, CRIMS, or residual strain).

This result shows the shrinkage computed without considering the structural influence of the surrounding part.

NOTE: This result is not available for 3D analysis technology.

Using this result

Use this result to find out whether differential shrinkage is likely to cause warpage. Differential shrinkage may be caused by differences in shrinkage values between different regions of the part, or by large differences between the parallel and perpendicular shrinkage.

This result is not displayed by default. To display this result, add a new plot to the display in the active study or customize the default results list to include this result.

Things to look for

Look for regions in which there is high differential shrinkage. These regions are more likely to deform.

Perpendicular shrinkage result 6

The Perpendicular shrinkage result indicates the percentage of shrinkage in each element in the plane of the element, at right angles to the local orientation direction, before warpage is calculated.

The local orientation direction is the direction of fiber orientation for fiber-filled materials and the direction of material orientation (flow direction before freezing) for all other materials.

This result is produced by a Shrink analysis based on predicted shrinkages from the specified material shrinkage model (residual stress, CRIMS, or residual strain).

This result shows the shrinkage computed without considering the structural influence of the surrounding part.

NOTE: This result is not available for 3D analysis technology.

Using this result

Use this result to find out whether differential shrinkage is likely to cause warpage. Differential shrinkage may be caused by differences in shrinkage values between different regions of the part, or by large differences between the parallel and perpendicular shrinkage.

This result is not displayed by default. To display this result, add a new plot to the display in the active study or customize the default results list to include this result.

Things to look for

Look for regions in which there is high differential shrinkage. These regions are more likely to deform.

Predicted error result 7

The Predictive error (PE) is the error associated with any shrinkage prediction for a chosen material, and is constant for that material.

It represents the confidence band for the shrinkage prediction and is calculated as the average error in predictions based on the error in the shrinkage model used.

The Predictive error (PE) is the error associated with any shrinkage prediction for a chosen material, and is constant for that material. It represents the confidence band for the shrinkage prediction and is calculated as the average error in predictions based on the error in the shrinkage model used.

Using this result

The graph allows you to compare the tolerances that you've specified for the part dimensions with the errors associated with the predictions. This is done by converting the predictive error to a distance that allows direct comparison with the distance range given by the specified tolerances.

Things to look for

Ideally the predicted errors should lie within the desired part tolerances, for each critical dimension. If the predictive errors are well beyond the part tolerance, then it is clear that the desired tolerances cannot be met with the chosen material.

Shrink analysis log—shrinkage reports

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This section of the analysis log shows the recommended shrinkage allowance value, which is the average isotropic shrinkage for the entire part.

Recommended Shrinkage Allowance Report

The predictive error associated with this value is also displayed. This predictive error represents a confidence band for the shrinkage prediction and is calculated as the average error in predictions based on the standard deviations calculated for the shrinkage testing data.

If the distribution of shrinkage across the part is uniform across each critical dimension, then this value can be used to cut the mold. The Shrinkage check plot result can be used to graphically examine whether it is feasible to apply this recommended shrinkage allowance to the entire part.

Component shrinkages report

This table shows the recommended shrinkage allowances along the X, Y and Z axes of the part, and the overall recommended shrinkage allowance as above.

The validity range for a given component is calculated by applying the predicted % tolerance to the recommended shrinkage allowance for that component.

The predicted tolerance is the predictive error plus the error associated with the variation in shrinkage across the part. This error may be different in each component direction, and over the entire part.

The final column shows the range of predicted shrinkage values in each component direction and across the part. The minimum value of the shrinkage range for a given direction may be zero if some region of the part has no shrinkage in that direction.

Shrink analysis log—dimension summary report

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The Dimension summary report table summarizes each critical dimension you have defined.

It also summarizes the actual mold dimension required to obtain the desired dimension in the molded part if the single recommended shrinkage allowance value is used for the entire part. The desired part dimension column shows the desired part dimension obtained from the part model and the -/+ tolerances entered when the critical dimension was set.

The required mold dimension is obtained by scaling up the desired part dimension value by applying the recommended shrinkage allowance for the entire part. The tolerance value reflects the total error associated with the shrinkage prediction. A zero or negative tolerance for the required mold dimension means that tolerance cannot be met for a critical dimension if you use the recommended shrinkage allowance when cutting that mold dimension. The message “Not Met” appears in the Warnings column of the table if this is the case.

The last column shows the predicted final part dimension if the recommended shrinkage allowance value is used to cut the mold.

If some critical dimensions are not within tolerance, check the Full Dimension Summary Report table to determine whether tolerances cannot be met when using single value shrinkages for component directions. If warnings appear only for the total direction then it is possible to use the single value shrinkages for each component direction.

NOTE: The Predicted error and Total error plots can be used to graphically assess whether the critical dimensions can be met using the recommended shrinkage allowance.

Full Dimension Summary Report

This table is similar to the dimension summary report, but also shows the required mold dimensions resolved into each of the component directions.

The recommended mold dimensions in the individual component directions may be useful when the material shrinks by different amounts in different directions, or when a critical dimension does not lie in one of the global coordinate planes.

NOTE: The tolerances on the required mold dimension for the component directions and the total part may be different because the predicted tolerance will be different for each direction (see the Component Shrinkage Table).

Shrinkage check plot result 10

This plot is used to visually assess whether or not it is valid to use the single value recommended shrinkage allowance, as reported in the analysis log, across the entire part when cutting the mold.

Using this result

Green Regions Green areas on the shrinkage check plot represent regions of the part where it is acceptable to apply the single value recommended shrinkage allowance. If all the critical dimensions on the part model lie within the green regions of the plot, it is valid to use the total recommended shrinkage allowance for the whole part.

Red Regions Red areas on the shrinkage check plot represent regions for which you cannot use a single value of shrinkage. This is because the shrinkages in these regions lie well outside the single value validity range.

Yellow Regions Yellow areas on the shrinkage check plot represent regions for which you may still be able to use a single value of shrinkage, but you need to examine more carefully the shrinkage variation across the part to determine whether a single value can confidently be used.

Total error result

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The Total error (TE) is the error associated with using a shrinkage allowance.

The total error represents the predictive error plus the error due to the variation in shrinkage across the part.

Using this result

The plot allows you to compare the desired part tolerances with the total error associated with the calculated shrinkage prediction. That is the total error, (represented by the sum of the predictive error and the error associated with the variation in shrinkage across the part) is converted to a distance and compared with the desired tolerance.

If all tolerances are met in the total error graph and all dimensions lie within green areas on the Shrinkage check plot result, you can confidently use the recommended shrinkage allowance to cut the mold. The required mold dimensions and the tolerance that must be met are presented in the Dimension Summary Report table of the Shrink analysis log.

Things to look for

If some critical dimensions are not within tolerance, check the Full Dimension Summary Report table to determine whether tolerances cannot be met when using single value shrinkages for component directions.

(X, Y, Z) component of shrinkage result

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The X, Y or Z component of shrinkage result indicate the percentage of shrinkage that occurs in the part in the direction of the X, Y and Z axes, respectively.

A part which is oriented perpendicular to an axis will show zero shrinkage in that axis' direction.

Using this result

Use this result to find out whether shrinkage is within part tolerances, and to see if differential shrinkage is likely to cause warpage.

Use the shrinkage result for a particular axis if a part has a critical dimension along that axis.

Things to look for

Look for regions in which there is high differential shrinkage. These regions are more likely to deform.