

Siemens PLM Software

NX Mold Flow Analysis solutions

Using mold filling simulation to optimize plastic part designs

Benefits

- Optimizes plastic part designs and molding process parameters
- Optimizes wall thickness for profitability
- Eliminates short shot and sink marks
- Manipulates weld line and air trap
- Reduces pressure drop
- Checks gate distribution for flow balance
- Validates flow balance of runners in multiple cavity mold
- Evaluates volumetric shrinkage due to temperature and pressure

Summary

NX™ software, the product development solution from Siemens PLM Software, offers a range of tools that help designers assess the moldability of plastic parts. These include:

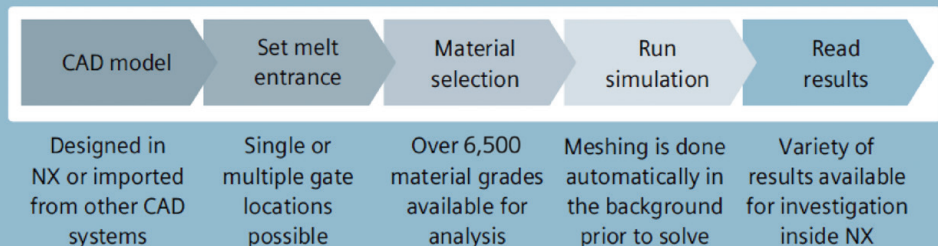
NX Molded Part Validation: evaluates part models for moldability and performs basic filling simulation

NX EasyFill Analysis: performs a variety of simulation options to evaluate molding issues that influence part quality

NX EasyFill Analysis – Advanced: performs advanced simulation of molding process parameters

These validation and mold flow analysis tools are intended for use by designers in the early stages of product development, and are fully integrated with NX design functions. They combine technologies from Siemens PLM Software and Moldex3D, a leading provider of computer-aided engineering (CAE) software for the plastics industry, to deliver intuitive injection molding simulations embedded in NX. Designers can easily set up and perform analysis with only a few clicks. The moldability validation and flow analysis tools enable you to identify and correct potential injection molding problems as you design the product.

Rapid filling simulation for CAD designers



NX Mold Flow Analysis solutions

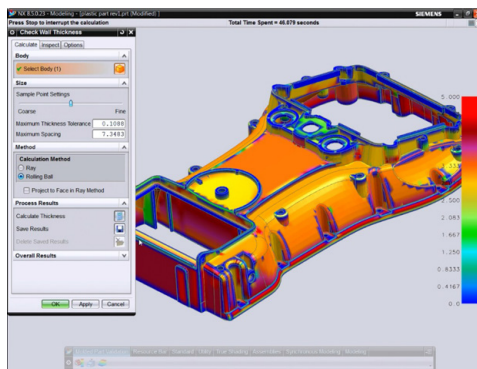
Features

- Fully embedded in NX so no additional training is needed
- Automated moldability validation checking of part models
- Automatic 3D mesh generation so no user intervention or CAD conversion is required
- Comprehensive plastic material database (over 6,500 material grades)
- Intuitive interface for specifying molding parameters
- Pioneering 3D technology for simulating more accurate results and rendering more comprehensive animations
- High-performance 3D molding simulations supported by parallel processing
- Easy-to-view displays of analysis results
- Report generator for efficient sharing of information

Capabilities

Moldability validation checking

NX Molded Part Validation enables you to examine 3D part models so you can identify features that could compromise the injection molding process. The automated checking allows you to identify draft angles, undercut areas, sharp corners and small radiuses, and other issues that can impede successful molding. In addition, this part validation function provides designers with an easy visual check of the core and cavity that doesn't require special analysis or knowledge of mold design.



Molded part validation is used to analyze the thickness of part models, providing designers with color-coded visual feedback on the thickness distribution. The information helps designers control cooling rates and part quality. Three-dimensional annotation can be used to document models for downstream processes.

Automatic meshing and injection knowledge

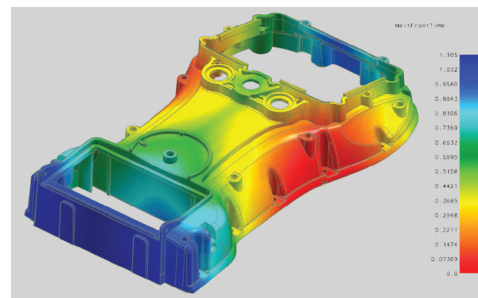
NX EasyFill uses proprietary automatic meshing technology that generates high-quality 3D analysis meshes from NX part models. No user interaction or knowledge of analysis modeling is required.

High-performance parallel computing

All of the flow simulation tools support parallel computing and can be used to reach the maximum acceleration by fully using each core of modern CPU architectures (maximum four cores).

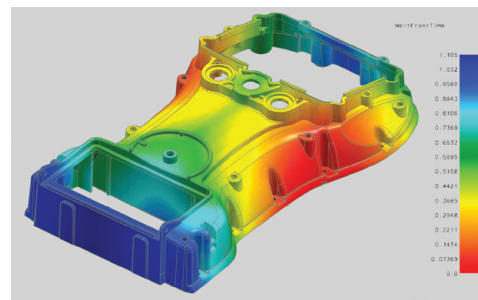
Melt-front time simulation

NX EasyFill helps designers explore the filling pattern of the mold by simulating melt-front time. This simulation enables you to check for potentially incomplete filling and unbalanced flow flashing problems, identifies weld line and air trap locations and much more. With the prediction of melt-front time from the field plot, users can check filling dynamics with the animation function to understand how well the filling process is working.



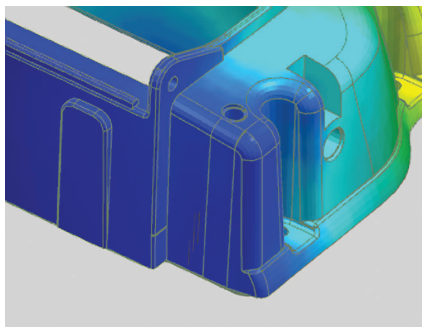
Air trap simulation

Designers can use NX EasyFill Analysis to visualize the position of air traps in the molding process. Different flow patterns cause a wide variety of air trap results, and EasyFill Analysis enables you to adjust venting designs to avoid such problems.



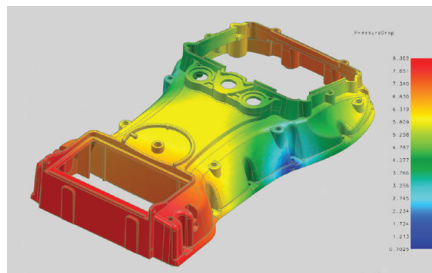
Weld-line simulation

Different flow patterns also lead to a wide variety of weld-line results, which can cause cosmetic blemishes or structural issues in parts. With NX EasyFill Analysis, you can observe the results and optimize gate locations.



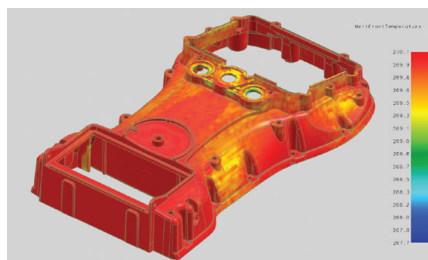
Pressure-drop analysis

NX EasyFill Analysis enables you to simulate the drop in pressure at the flow front of the plastic due to drag and frictional effects in the mold. The pressure-drop simulation displays the pressure distribution of the part cavity at the end of filling (EOF) stage. From the pressure distribution, you can check the pressure transmission and evaluate flow balance of the design.



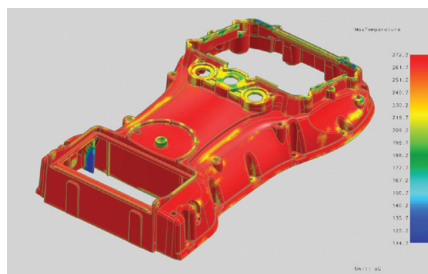
Melt-front temperature prediction

Designers can use NX EasyFill Analysis to predict the melt-front temperature as it reaches each point in the mold cavity, simulating how heat is conveyed and dissipated in the molding process. The results help designers identify areas of excessive heating or cooling, and to determine the appropriate fill speed for uniform temperature distribution.



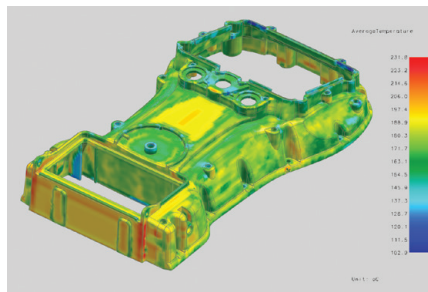
Maximum temperature

NX EasyFill allows you to calculate and display the maximum temperature distribution during the filling process. Designers can readily assess the temperature distribution in three dimensions for the full cavity.



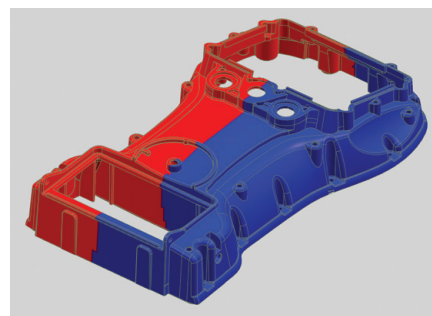
Average temperature

With the average temperature simulation in NX EasyFill, designers can check the combined effects of viscous heating of polymer melt and mold cooling across the part thickness at any instant. The results help identify hot spots that could cause burning or short shots due to flow hesitation or excess mold cooling.



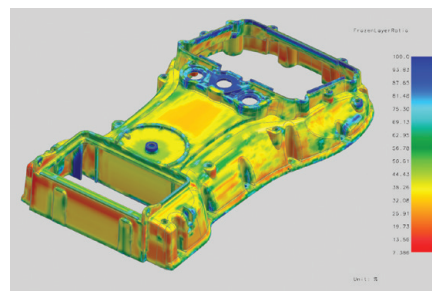
Gate contribution simulation

Designers can use NX EasyFill to calculate each gate's percentage of total plastic flow into the cavity. Designers can use the result to achieve better flow balance for improved product and process quality.



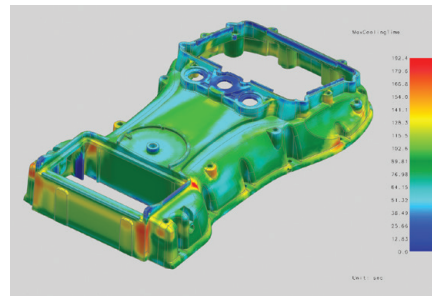
Frozen layer ratio

NX EasyFill enables you to simulate solidification of frozen layers near the cavity surface caused by cooling. Designers can use the frozen layer ratio results to assess reductions in flow path cross-section, increases in flow resistance and sprue pressure, residual stresses and impacts on flow-induced orientation.



Maximum cooling-time analysis

The maximum cooling time calculated by using NX EasyFill Analysis shows the estimated cooling time required under

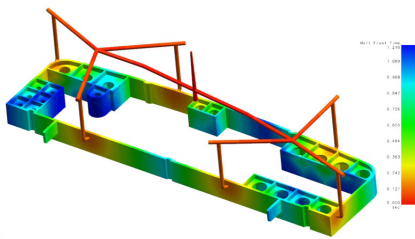


the given design and process conditions. This is the time estimated from cooling analysis for the computed mold cavity surface temperature, and the estimated center temperature of the plastic part to be cooled enough to

be ejected. This value can be used as an indicator of hot spot and cycle time-restriction locations.

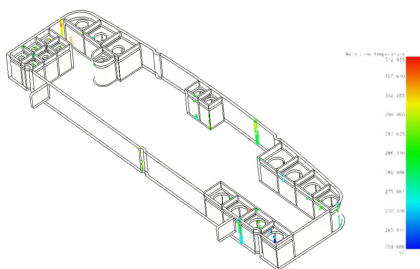
Runner Design Wizard

The Runner Design Wizard helps you better describe the real runner geometry and improve simulation accuracy. You can more easily build various plastic feeding systems based on part geometry.



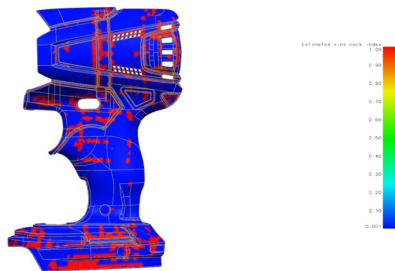
Weld-line temperature and meeting angle

Weld lines can compromise the appearance and strength of plastic parts. NX EasyFill Advanced provides the weld-line temperature distribution and meeting angle prediction. To eliminate weld lines, you can enlarge the meeting angle by optimizing wall thickness, gate and runner designs and re-validate the result.



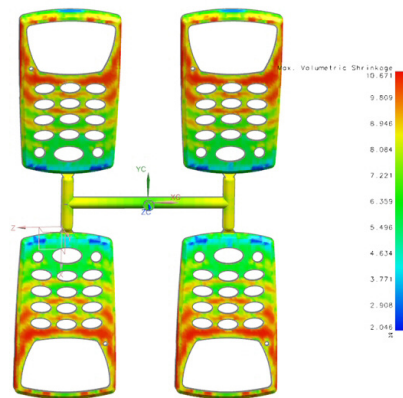
Sink mark simulation

NX EasyFill Advanced enables you to visualize and evaluate sink mark displacement across the entire cavity surface. You can significantly improve part appearance by optimizing the design and process to avoid sink marks.



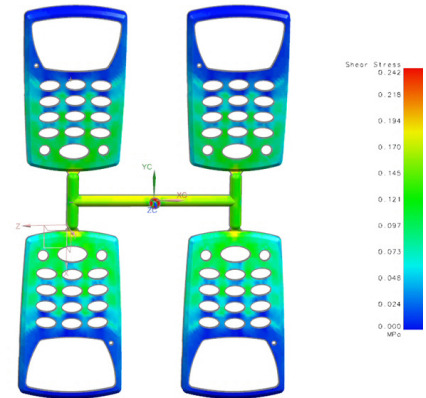
Volumetric shrinkage simulation

NX EasyFill Advanced enables you to visualize the distribution of part volume change percentage as the part is cooled from high temperature and pressure to ambient temperature and pressure. You can improve process conditions to prevent severe part shrinkage.



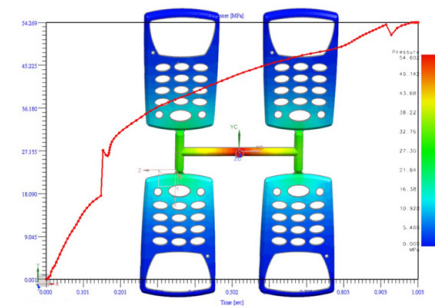
Shear stress and shear rate simulation

NX EasyFill Advanced enables you to visualize shear stress and rate distributions, helping you check if nonuniform shear stress or high shear rate tend to cause warpage or weaken part strength.



Filling curve analysis

The XY plot for melt-front time shows the history curve of sprue pressure with respect to time during the filling stage, allowing you to realize the filling variation over time in the cavity.



Functionality matrix

Capabilities	NX Molded Part Validation (NX 30688) <i>Included in NX Mach 3 Mold Design NX13200</i>	NX EasyFill Analysis (NX 30155)	NX EasyFill Analysis - Advanced (NX 30157)
Material grades	6,500+	6,500+	6,500+
Process simulation	Filling	Filling	Filling / packing
Gate number	Single	Single or multiple	Single or multiple
Runner support	No	No	Yes
Melt-front advancement	Yes	Yes	Yes
Air trap	No	Yes	Yes
Weld line	No	Yes	Yes
Weld-line temperature	No	No	Yes
Weld-line meeting angle	No	No	Yes
Gate contribution	No	Yes	Yes
Cavity pressure drop	No	Yes	Yes
Melt-front temperature	No	Yes	Yes
Maximum temperature	No	Yes	Yes
Average temperature	No	Yes	Yes
Frozen layer ratio	No	Yes	Yes
Maximum cooling time	No	Yes	Yes
Sink-mark displacement	No	No	Yes
Volumetric shrinkage	No	No	Yes
Shear stress	No	No	Yes
Shear rate	No	No	Yes
Filling XY plot	No	No	Yes
Result indicators	No	No	Yes
Multi-core support	Yes (maximum 4)	Yes (maximum 4)	Yes (maximum 4)

Packaging and availability

NX Molded Part Validation [NX30688], NX EasyFill Analysis [NX30155] and NX EasyFill Analysis – Advanced [NX30157] are available as add-on software applications for NX Gateway and NX Mach Series solutions that run on Windows operating systems. NX Molded Part Validation capabilities are included in the NX Mach 3 Mold Design solution [NX13200]

NX EasyFill and NX EasyFill - Advanced software are available for download from:
<https://download.industrysoftware.automation.siemens.com/unigraphics/moldwizard/nx9>

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