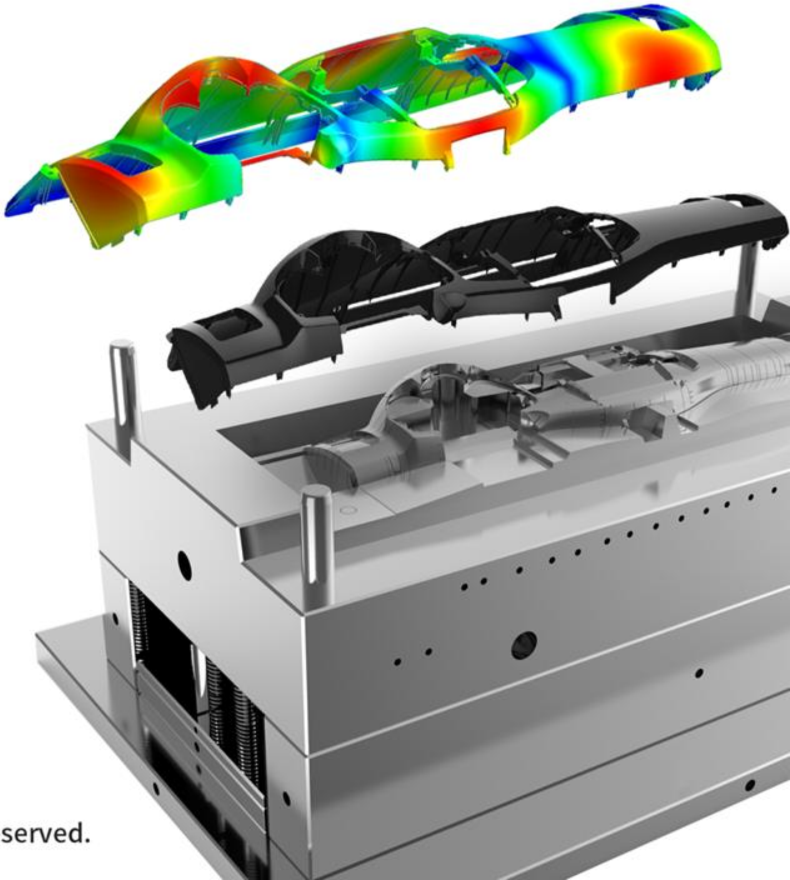
What’s New in R16

Version: R16



www.moldex3d.com

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Supported Platforms

- Moldex3D supports Windows 64-bit platform for all purposes such as pre-processing, solving and post-processing, and Linux platform is supported as calculation resource
- Moldex3D Mesh R16 for Rhino5 64-bit platform only

Platform	OS	Remark
Windows / x86-64	Windows 10 family Windows 8 family Windows 7 family Windows Server 2008 R2 Windows HPC Server 2008 R2 Windows Server 2012 Windows Server 2016	Moldex3D R16 is certified for Windows 10
Linux / x86-64	CentOS 6 family CentOS 7 family RHEL 6 family RHEL 7 family SUSE Linux Enterprise Server 11 SP2	Linux platform is used for calculation resource only. Moldex3D LM, Pre-processor and post-processor do not support Linux platform

* Moldex3D LM server supported platform will switch to Windows 64-bit OS next official release in 2019 and R16 LM is the last version that supports Windows 32-bit OS

Terminology Change

- Moldex3D R16
  - Remove sub-version number known as “.0” in the official product name
- Foam Injection Molding (FIM)
  - Rename the application type which is previously known as Microcellular Injection Molding (MCIM)
- Molten Core
  - Rename result item in filling, packing and cooling analysis which is previously known as melting core
- Joint Type
  - Rename the term for the junction between two curves in runner or cooling channel which is previously known as node type

Terminology Definition

- Clamping Force Centroid
  - The clamping force centroid shows the center of the clamping force at the moment of peak

- Pin Movement
  - New capability in advanced hot runner (AHR) module to simulate pin movement with profiled speed setting

Announcement

- New License Architecture
  - The lighter and flexible new R16 license is implemented to make a better user experience

- Moldex3D Project Files
  - Moldex3D eDesign project is switched from *.mvj to *.m3j that unify the previously two 3D projects, eDesign and Solid, to be only one single file extension

- Moldex3D 64-bit LMSR
  - Moldex3D LMSR application known as Moldex3D License-Admin is going to switch the supported platform to 64-bit Windows OS and plan to terminate 32-bit program next official release in 2019

Moldex3D R16 Highlights

- Coupled VE-Flow Analysis
- Full Moldbase Non-matching Technology
- Boost Design Verification Productivity
- Long Fiber Prediction Achievement
- Simulation Workflow Automation Tool

More Enhancements in Moldex3D R16

- > More Enhancements in Solver
- > More Enhancements in Pre-processor
- > More Enhancements in UI
- > More Enhancements in Solution Add-On
- > More Enhancements in Moldex3D Studio (Beta)

Coupled VE-Flow Analysis

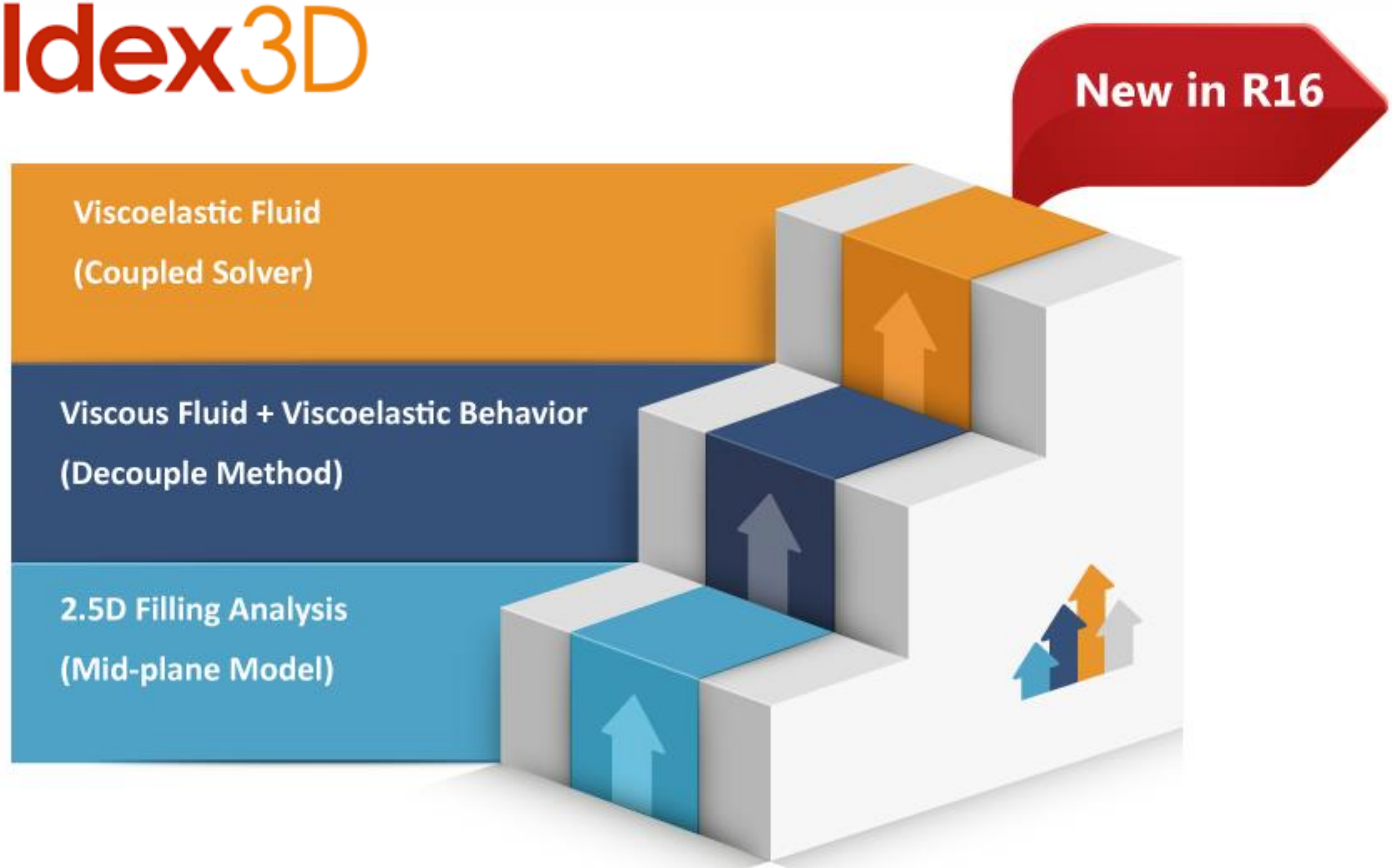
New Generation Viscoelastic Flow Solver

> Fluid Analysis with Coupled VE Technology
  - The viscoelastic (VE) character of plastics is taken into account and coupled during the molding simulation
  - Upgrade kernel from viscous fluid to viscoelastic fluid to simulate such phenomena as die swell, jetting and buckling

> Benefit
  - Improved optics and warpage prediction
  - Pioneered analysis technology of Viscoelastic Fluid
  - One step further to explorer the tricky issues such as ear flow, tiger stripe and more…

Core Technology Revolution in Solver

Moldex3D


New in R16

Viscoelastic Fluid

(Coupled Solver)

Viscous Fluid + Viscoelastic Behavior

(Decouple Method)

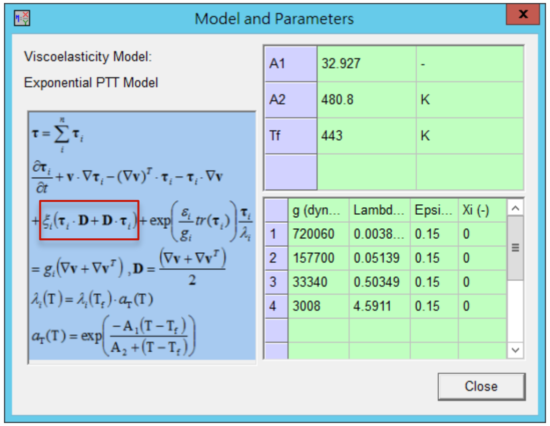
2.5D Filling Analysis

(Mid-plane Model)

1995 Moldex (Shell) → 2002 Moldex3D (3D) → 2018 Moldex3D (3D + VE)

Improve for Complete PTT Model

- Enhance flow-induced residual stress prediction
  - **Second Normal Stress Coefficient ψ_2**



Viscoelasticity Model:
Exponential PTT Model

$$\boldsymbol{\tau} = \sum_i^n \boldsymbol{\tau}_i$$

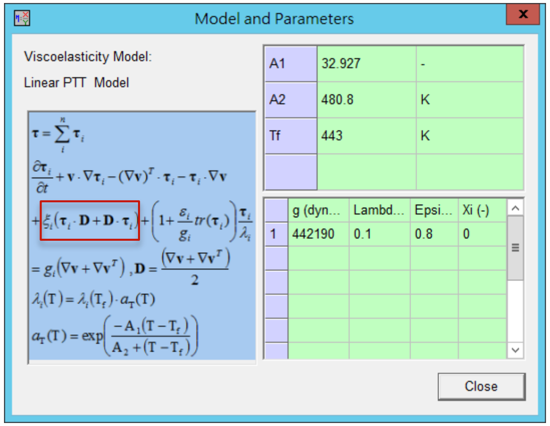
$$\frac{\partial \boldsymbol{\tau}_i}{\partial t} + \mathbf{v}\cdot\nabla\boldsymbol{\tau}_i - (\nabla\mathbf{v})^T\cdot\boldsymbol{\tau}_i - \boldsymbol{\tau}_i\cdot\nabla\mathbf{v} + \boxed{\xi_i(\boldsymbol{\tau}_i\cdot\mathbf{D} + \mathbf{D}\cdot\boldsymbol{\tau}_i)} + \exp\left(\frac{\varepsilon_i}{g_i} tr(\boldsymbol{\tau}_i)\right)\frac{\boldsymbol{\tau}_i}{\lambda_i} = g_i\left(\nabla\mathbf{v} + \nabla\mathbf{v}^T\right), \mathbf{D} = \frac{\left(\nabla\mathbf{v} + \nabla\mathbf{v}^T\right)}{2}$$

$$\lambda_i(\mathrm{T}) = \lambda_i(\mathrm{T}_f)\cdot a_{\mathrm{T}}(\mathrm{T})$$

$$a_{\mathrm{T}}(\mathrm{T}) = \exp\left(\frac{-\mathrm{A}_1(\mathrm{T}-\mathrm{T}_f)}{\mathrm{A}_2 + (\mathrm{T}-\mathrm{T}_f)}\right)$$

A1	32.927	-
A2	480.8	K
Tf	443	K

	g (dyn...	Lambd...	Epsi...	Xi (-)
1	720060	0.0038...	0.15	0
2	157700	0.05139	0.15	0
3	33340	0.50349	0.15	0
4	3008	4.5911	0.15	0



Viscoelasticity Model:
Linear PTT Model

$$\boldsymbol{\tau} = \sum_i^n \boldsymbol{\tau}_i$$

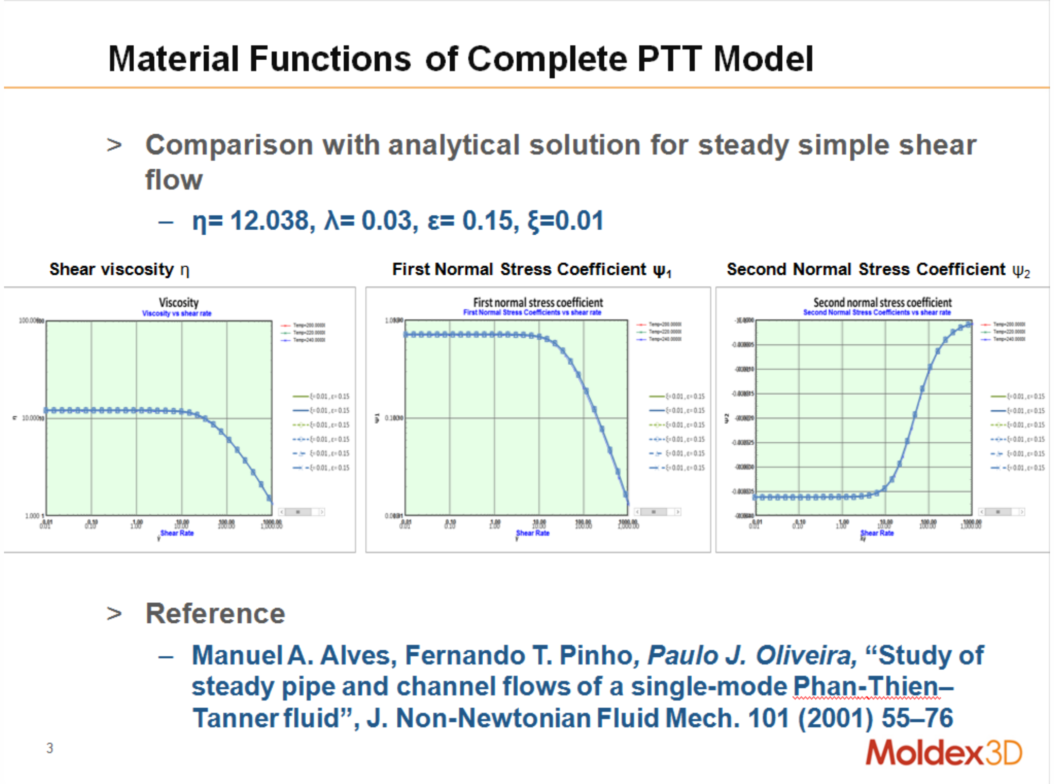
$$\frac{\partial \boldsymbol{\tau}_i}{\partial t} + \mathbf{v}\cdot\nabla\boldsymbol{\tau}_i - (\nabla\mathbf{v})^T\cdot\boldsymbol{\tau}_i - \boldsymbol{\tau}_i\cdot\nabla\mathbf{v} + \boxed{\xi_i(\boldsymbol{\tau}_i\cdot\mathbf{D} + \mathbf{D}\cdot\boldsymbol{\tau}_i)} + \left(1 + \frac{\varepsilon_i}{g_i} tr(\boldsymbol{\tau}_i)\right)\frac{\boldsymbol{\tau}_i}{\lambda_i} = g_i\left(\nabla\mathbf{v} + \nabla\mathbf{v}^T\right), \mathbf{D} = \frac{\left(\nabla\mathbf{v} + \nabla\mathbf{v}^T\right)}{2}$$

$$\lambda_i(\mathrm{T}) = \lambda_i(\mathrm{T}_f)\cdot a_{\mathrm{T}}(\mathrm{T})$$

$$a_{\mathrm{T}}(\mathrm{T}) = \exp\left(\frac{-\mathrm{A}_1(\mathrm{T}-\mathrm{T}_f)}{\mathrm{A}_2 + (\mathrm{T}-\mathrm{T}_f)}\right)$$

A1	32.927	-
A2	480.8	K
Tf	443	K

	g (dyn...	Lambd...	Epsi...	Xi (-)
1	442190	0.1	0.8	0



Material Functions of Complete PTT Model

- Comparison with analytical solution for steady simple shear flow
  - η= 12.038, λ= 0.03, ε= 0.15, ξ=0.01

Shear viscosity η | First Normal Stress Coefficient ψ_1 | Second Normal Stress Coefficient ψ_2

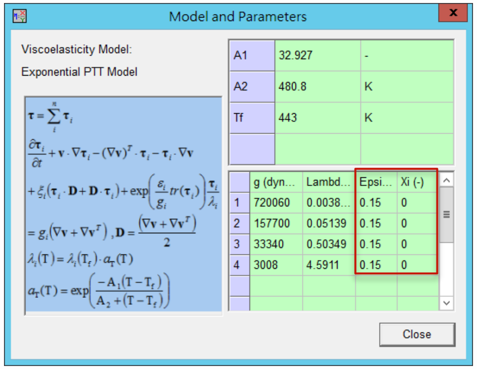
- Reference
  - Manuel A. Alves, Fernando T. Pinho, *Paulo J. Oliveira*, "Study of steady pipe and channel flows of a single-mode Phan-Thien–Tanner fluid", J. Non-Newtonian Fluid Mech. 101 (2001) 55–76

3

Support Multi Mode for Non-Linear Parameters

> Non-linear parameters of VE property set by different mode

- Allow more fitting capacity for fluid VE, such as fitting elongational viscosity
- Supported model: Linear PTT, Exponential PTT and Giesekus



Viscoelasticity Model:

Exponential PTT Model

$$\boldsymbol{\tau} = \sum_{i}^{n} \boldsymbol{\tau}_i$$

$$\frac{\partial \boldsymbol{\tau}_i}{\partial t} + \mathbf{v}\cdot\nabla\boldsymbol{\tau}_i - (\nabla\mathbf{v})^T\cdot\boldsymbol{\tau}_i - \boldsymbol{\tau}_i\cdot\nabla\mathbf{v}$$

$$+\xi_i(\boldsymbol{\tau}_i\cdot\mathbf{D}+\mathbf{D}\cdot\boldsymbol{\tau}_i) + \exp\left(\frac{\varepsilon_i}{g_i}tr(\boldsymbol{\tau}_i)\right)\frac{\boldsymbol{\tau}_i}{\lambda_i}$$

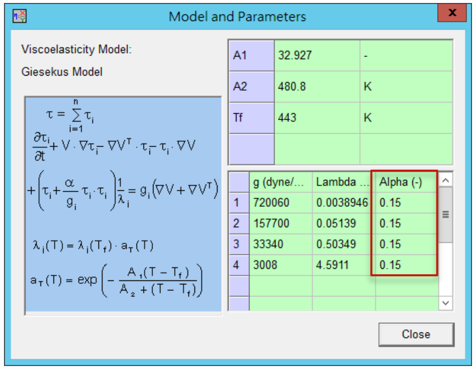
$$= g_i(\nabla\mathbf{v}+\nabla\mathbf{v}^T)\ ,\mathbf{D} = \frac{(\nabla\mathbf{v}+\nabla\mathbf{v}^T)}{2}$$

$$\lambda_i(\mathrm{T}) = \lambda_i(\mathrm{T}_f)\cdot a_{\mathrm{T}}(\mathrm{T})$$

$$a_{\mathrm{T}}(\mathrm{T}) = \exp\left(\frac{-\mathrm{A}_1(\mathrm{T}-\mathrm{T}_f)}{\mathrm{A}_2+(\mathrm{T}-\mathrm{T}_f)}\right)$$

A1	32.927	-
A2	480.8	K
Tf	443	K

	g (dyn...	Lambd...	Epsi...	Xi (-)
1	720060	0.0038...	0.15	0
2	157700	0.05139	0.15	0
3	33340	0.50349	0.15	0
4	3008	4.5911	0.15	0



Viscoelasticity Model:

Giesekus Model

$$\tau = \sum_{i=1}^{n} \tau_i$$

$$\frac{\partial \tau_i}{\partial t} + V\cdot\nabla\tau_i - \nabla V^T\cdot\tau_i - \tau_i\cdot\nabla V$$

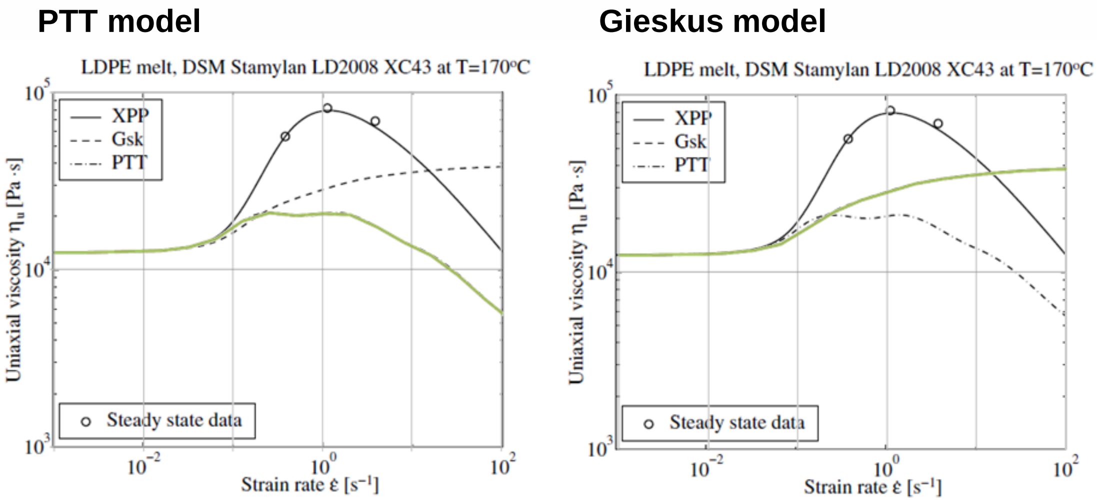
$$+\left(\tau_i + \frac{\alpha}{g_i}\tau_i\cdot\tau_i\right)\frac{1}{\lambda_i} = g_i(\nabla V + \nabla V^T)$$

$$\lambda_i(T) = \lambda_i(T_f)\cdot a_T(T)$$

$$a_T(T) = \exp\left(-\frac{A_1(T-T_f)}{A_2+(T-T_f)}\right)$$

A1	32.927	-
A2	480.8	K
Tf	443	K

	g (dyne/...	Lambda ...	Alpha (-)
1	720060	0.0038946	0.15
2	157700	0.05139	0.15
3	33340	0.50349	0.15
4	3008	4.5911	0.15



PTT model

Gieskus model

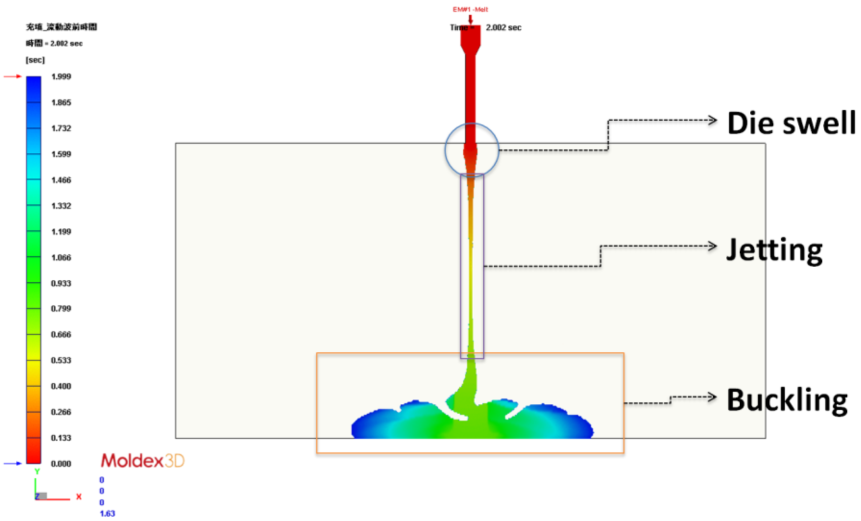
Comparison of elongational viscosity to reference

Ref. : Wilco M. H. Verbeeten "Computational Polymer Melt Rheology"

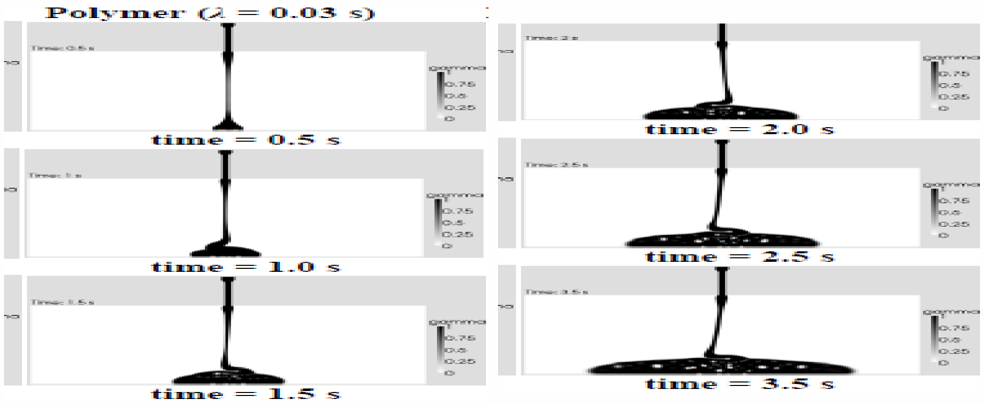
Enhance Flow Simulation with Viscoelastic Effect

- Viscoelastic free-surface effects
  - Die swell
  - Jetting
  - Bucking

Time-series animation of melt front time


充填_流動波前時間
時間 = 2.002 sec
[sec]
1.999
1.865
1.732
1.599
1.466
1.332
1.199
1.066
0.933
0.799
0.666
0.533
0.400
0.266
0.133
0.000
EM#1 -Melt
Time = 2.002 sec
Die swell
Jetting
Buckling
Moldex3D
Y
X
0
0
0
1.63

Simulation result from Literature

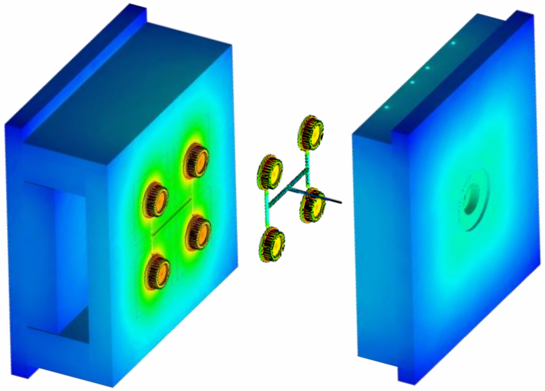


Ref. : J. L. Favero, “Viscoelatic fluid analysis in internal and in free surface using the software OpenFOAM

Full Moldbase Non-matching Technology

Allow Full Moldbase with Non-matching Faces

- Support complete moldbase components
  - All moldbase components are fully supported to be non-matched for standard solid cool approach
  - Provide new attributes, Mold Plate (Movable) and Mold Plate (Fixed) for detailed moldbase modeling
- Benefit
  - To assign different mold plate materials individually and visualize the temperature of parting plane
  - To reduce effort to generate solid moldbase mesh for better resolution and accurate prediction

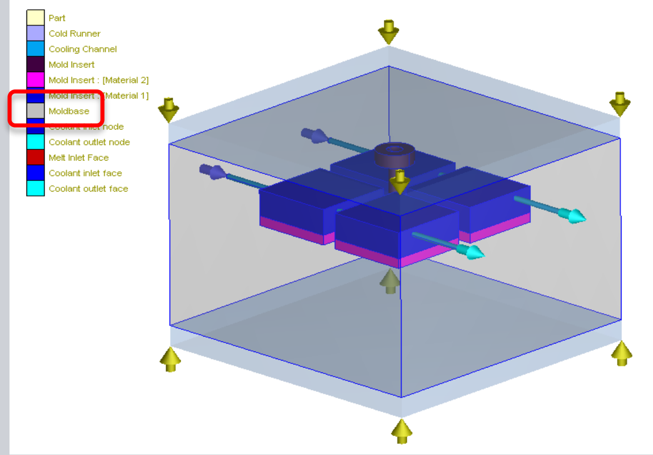


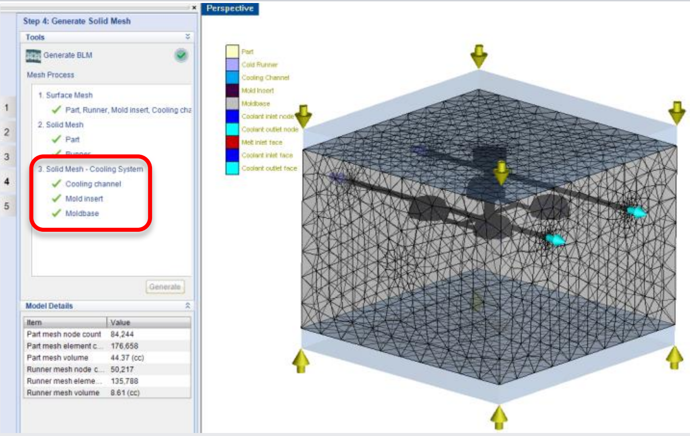
New Generation Non-matching Technology

	Non-matching Mehs in R14.0	Non-matching Mesh R15.0	**Non-matching Mesh in R16**
Part Insert	√	√	√
Mold Base System	Not Supported	- Cooling Channel - Heating Rod - Moldbase	- Cooling Channel - Heating Rod - Moldbase - Mold Insert - Mold Plate (New Attribute)
Mold Base Mesh	Auto-grid (Fast Cool)	Solid Mesh (Standard Cool)	Solid Mesh (Standard Cool)

Non-matching Moldbase vs. Non-matching Mold Plate

Non-matching Moldbase (Bounding Box)


Part
Cold Runner
Cooling Channel
Mold Insert
Mold Insert : [Material 2]
Mold Insert : [Material 1]
Moldbase
Coolant inlet node
Coolant outlet node
Melt Inlet Face
Coolant inlet face
Coolant outlet face


Perspective
Part
Cold Runner
Cooling Channel
Mold Insert
Moldbase
Coolant inlet node
Coolant outlet node
Melt inlet face
Coolant inlet face
Coolant outlet face
Tools
Generate BLM
Generate

Step 4: Generate Solid Mesh

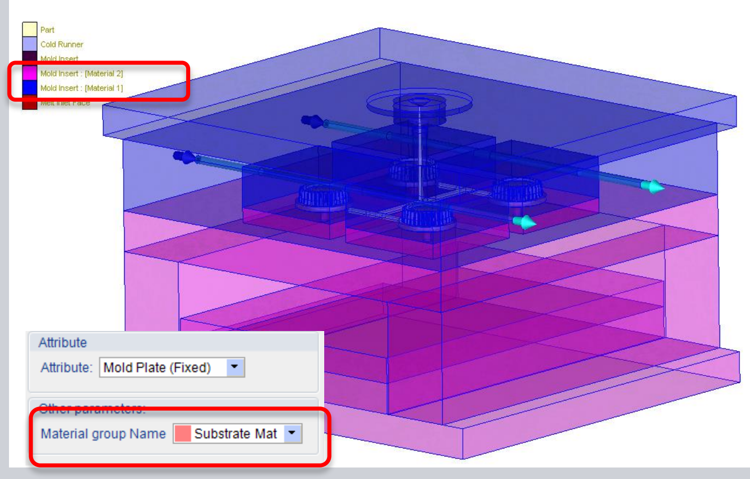
Mesh Process

1. Surface Mesh
   - ✓ Part, Runner, Mold insert, Cooling cha
2. Solid Mesh
   - ✓ Part
   - ✓ Runner
3. Solid Mesh - Cooling System
   - ✓ Cooling channel
   - ✓ Mold insert
   - ✓ Moldbase

Model Details

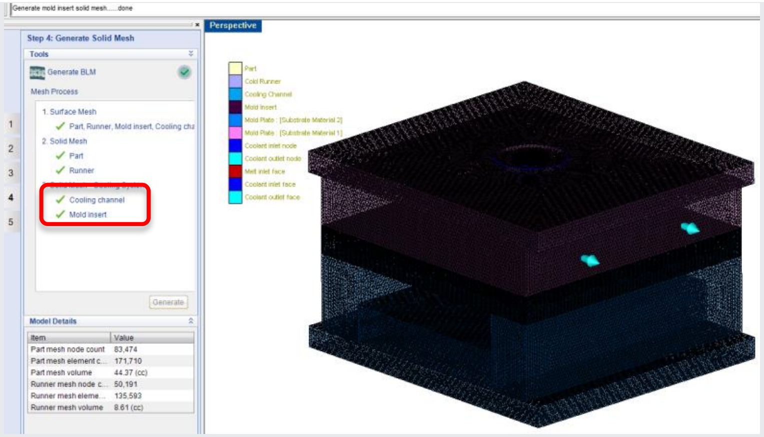
Item	Value
Part mesh node count	84,244
Part mesh element c...	176,658
Part mesh volume	44.37 (cc)
Runner mesh node c...	50,217
Runner mesh eleme...	135,788
Runner mesh volume	8.61 (cc)

Non-matching Mold Plate (Actual Geometry)


Part
Cold Runner
Mold Insert
Mold Insert : [Material 2]
Mold Insert : [Material 1]
Melt Inlet Face
Attribute
Other parameters:

Attribute: Mold Plate (Fixed)

Material group Name: Substrate Mat


Perspective
Part
Cold Runner
Cooling Channel
Mold Insert
Mold Plate : [Substrate Material 2]
Mold Plate : [Substrate Material 1]
Coolant inlet node
Coolant outlet node
Melt inlet face
Coolant inlet face
Coolant outlet face
Tools
Generate BLM
Generate

Generate mold insert solid mesh......done

Step 4: Generate Solid Mesh

Mesh Process

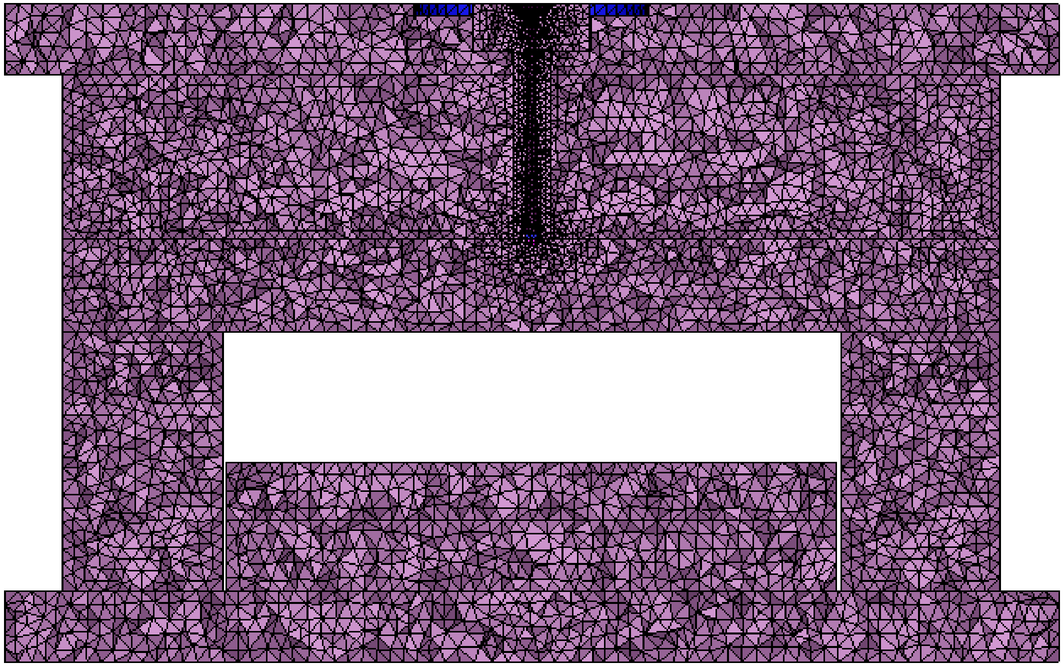
1. Surface Mesh
   - ✓ Part, Runner, Mold insert, Cooling cha
2. Solid Mesh
   - ✓ Part
   - ✓ Runner
3. Solid Mesh - Cooling System
   - ✓ Cooling channel
   - ✓ Mold insert

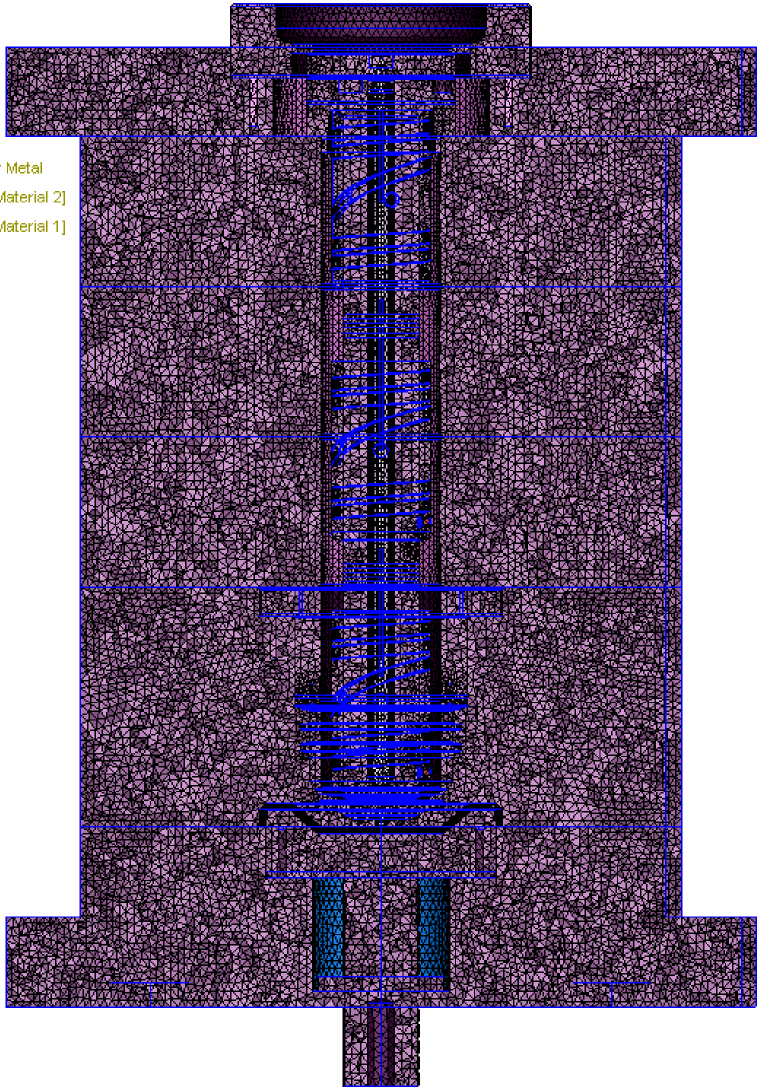
Model Details

Item	Value
Part mesh node count	83,474
Part mesh element c...	171,710
Part mesh volume	44.37 (cc)
Runner mesh node c...	50,191
Runner mesh eleme...	135,593
Runner mesh volume	8.61 (cc)

Non-matching Model with Other Components

- Support Non-matching mold plate with:
  - **Hot Runner Metal** →
  - **Mold Insert** ↓

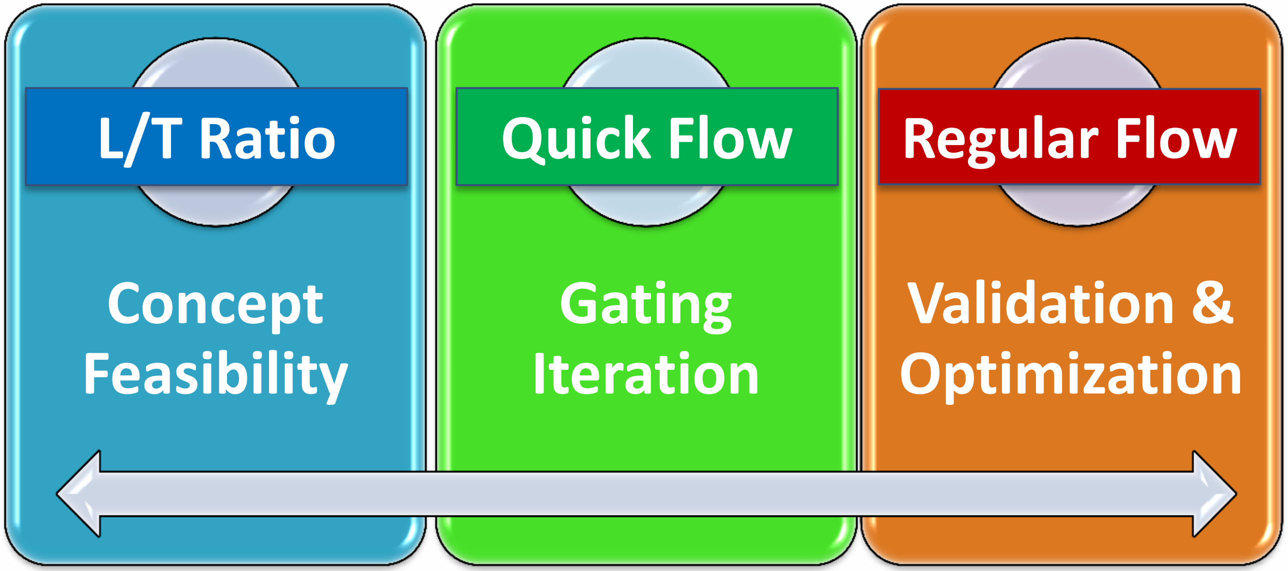



Part
Hot Runner
Heating Rod
Mold Insert / Hot Runner Metal
Mold Plate : [Substrate Material 2]
Mold Plate : [Substrate Material 1]
Sensor Node
Melt Inlet face

Boost Design Verification Productivity

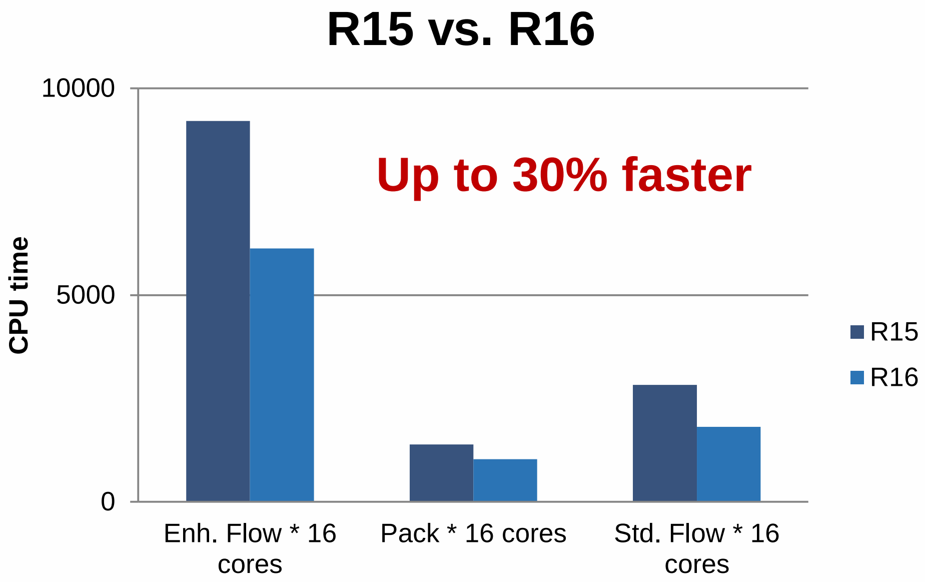
Boost Design Verification Productivity

- Various approaches for different design stages
  - L/t Ratio: To obtain the filling-like pattern in seconds **Enhanced**
  - Quick Flow: Accelerated flow analysis completed in minutes **New**
  - Regular Flow: Enhanced calculation performance **Enhanced**
- **Benefit**
  - Get the best analysis productivity according to the situation with different methods which adopted different approaches


L/T Ratio
Concept Feasibility
Quick Flow
Gating Iteration
Regular Flow
Validation & Optimization

Enhancements in Calculation Efficiency

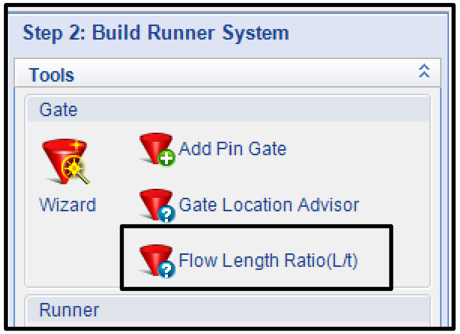
- Up to Better calculation performance
  - Improved data structure for higher accessing efficiency
  - Improved efficiency for matrix solver
  - Improved data transferring efficiency in parallel computing
- **Benefit**
  - Better leverage the computation resource before hardware investment

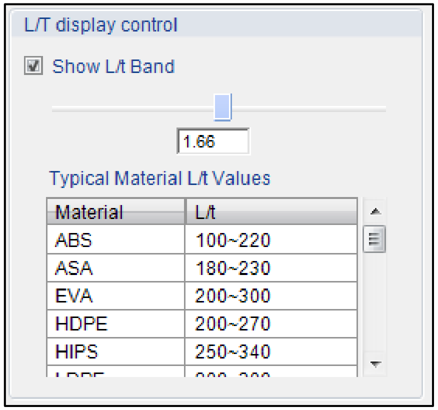


*. A case with element number= 4,813,180

Enhancements in L/t Ratio

> Verify ideas instantly
  - Upgraded UI of L/t function for better user experience
  - Improved kernel is for better result and display performance
  - Typical material L/t value is provided as reference


Step 2: Build Runner System
Tools
Gate
Wizard
Add Pin Gate
Gate Location Advisor
Flow Length Ratio(L/t)
Runner

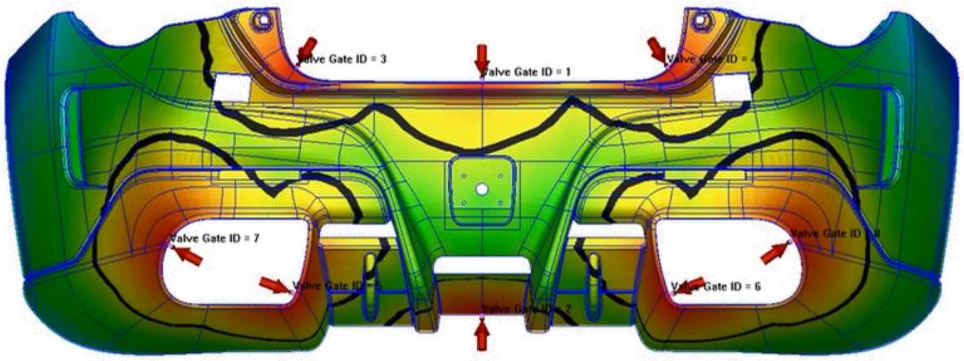

L/T display control

☑ Show L/t Band

1.66

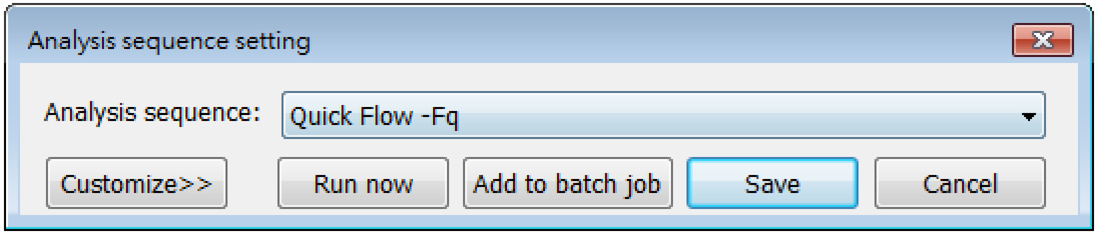
Typical Material L/t Values

Material	L/t
ABS	100~220
ASA	180~230
EVA	200~300
HDPE	200~270
HIPS	250~340


Valve Gate ID = 3
Valve Gate ID = 1
Valve Gate ID = 4
Valve Gate ID = 7
Valve Gate ID = 8
Valve Gate ID = 5
Valve Gate ID = 6
Valve Gate ID = 2

New Analysis Sequence – Quick Flow

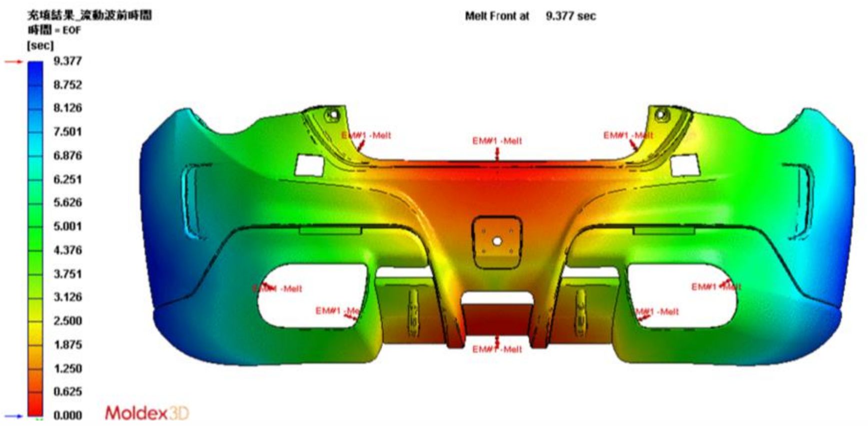
- New analysis sequence item
  - One set of fixed solver parameter is imbedded when Quick Flow – Fq selected
  - A special analysis for the model that contains gate design only
  - Speedup the iteration in gating design verification for big parts



Analysis sequence setting

Analysis sequence: Quick Flow -Fq

Customize>>
Run now
Add to batch job
Save
Cancel


充填結果_流動波前時間
時間 = EOF
[sec]
9.377
8.752
8.126
7.501
6.876
6.251
5.626
5.001
4.376
3.751
3.126
2.500
1.875
1.250
0.625
0.000
Melt Front at 9.377 sec
EM#1 -Melt
Moldex3D

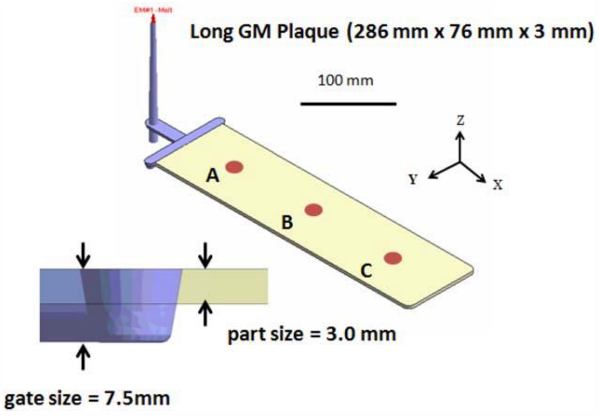
	Elapse CPU time
Quick Flow	574 sec (10 min)
Enh. Flow	9,397 sec (2.6 hr)

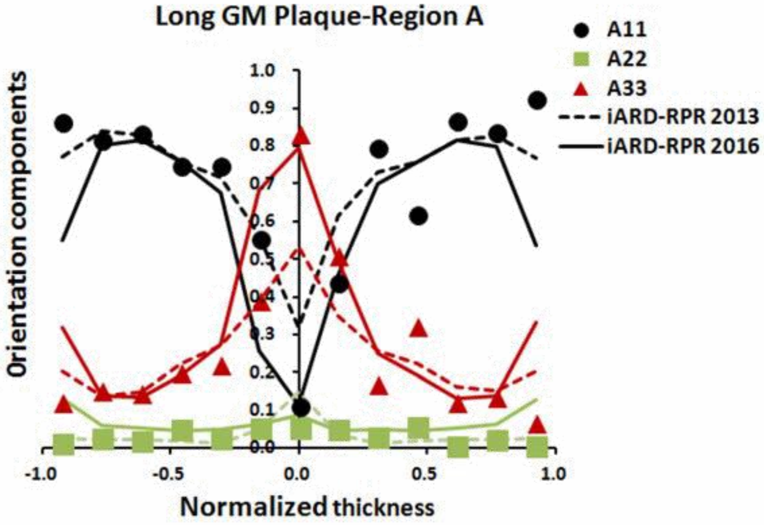
Comparison based on the same mesh and process condition

Long Fiber Prediction Achievement

Long Fiber Prediction

- Improved Fiber Orientation Predictions
  - To capture broader core region of the fiber orientation structure for fiber-filled parts in the injection molding process
  - Apply Cross-WLF Viscosity model with consideration of Herschel-Buckley Yield-Stress


Long GM Plaque (286 mm x 76 mm x 3 mm)
100 mm
Z
Y
X
A
B
C
part size = 3.0 mm
gate size = 7.5mm



Journal Publisher: Polymer Composites 2017

Adding Herschel-Buckley Yield-Stress to Cross-WLF Viscosity model

$$\eta = \boxed{\eta_y(\dot{\gamma}, T)} + \boxed{\frac{\eta_0(T,P)}{1+\left(\frac{\dot{\gamma}}{\dot{\gamma}_{cy}}\right)^{1-n}}}$$

Yield-Stress Viscosity

Cross-WLF model

$$\eta_0 = D_1 \exp\left(\frac{-A_1(T-T_c)}{A_2+(T-T_c)}\right)$$

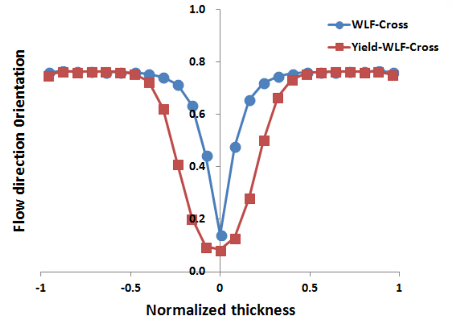
$$T_c = D_2 + D_3 P \qquad A_2 = \tilde{A}_2 + D_3 P$$

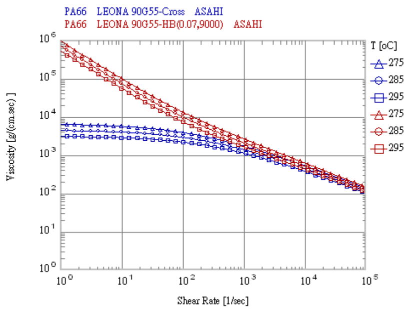
Herschel-Buckley Yield-Stress Viscosity with respect to temperature

$$\eta_y(\dot{\gamma}, T) = \frac{\tau_{y0}\exp(\frac{T_y}{T})}{\dot{\gamma}}$$

Contribution of US Patent and Journal Paper

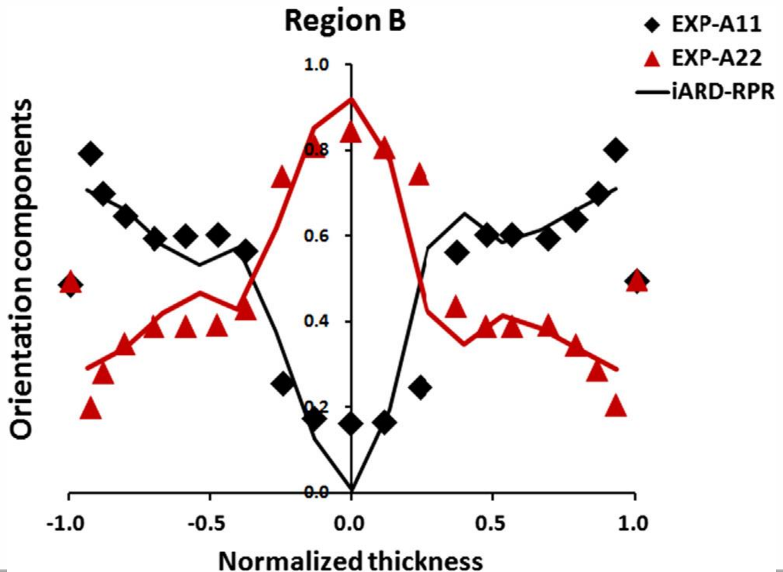
- This yield stress viscosity is considered to improve orientation prediction of core region that has been applied in US Patent 2016 and published in Journal – Composite A 2017





$$\eta(\dot{\gamma},T,P)=\frac{\tau_y}{\dot{\gamma}}+\frac{\eta_0(T,P)}{1+\left(\frac{\eta_0\dot{\gamma}}{\tau^*}\right)^{1-n}}$$

composites
Part A: applied science and manufacturing



The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

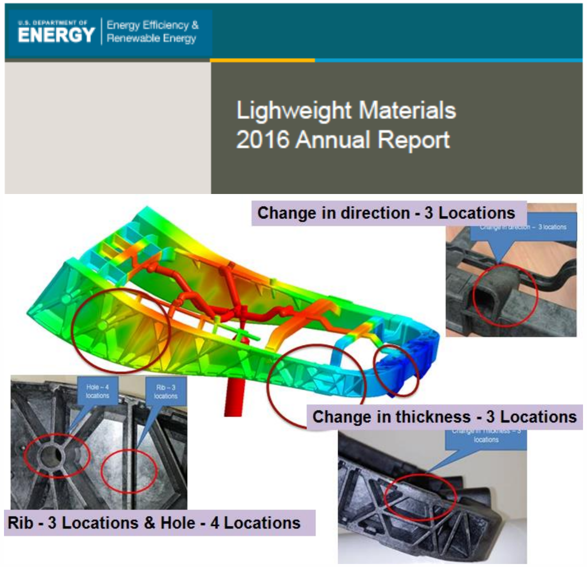
Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Michelle K. Lee

Director of the United States Patent and Trademark Office

Experimental Validation

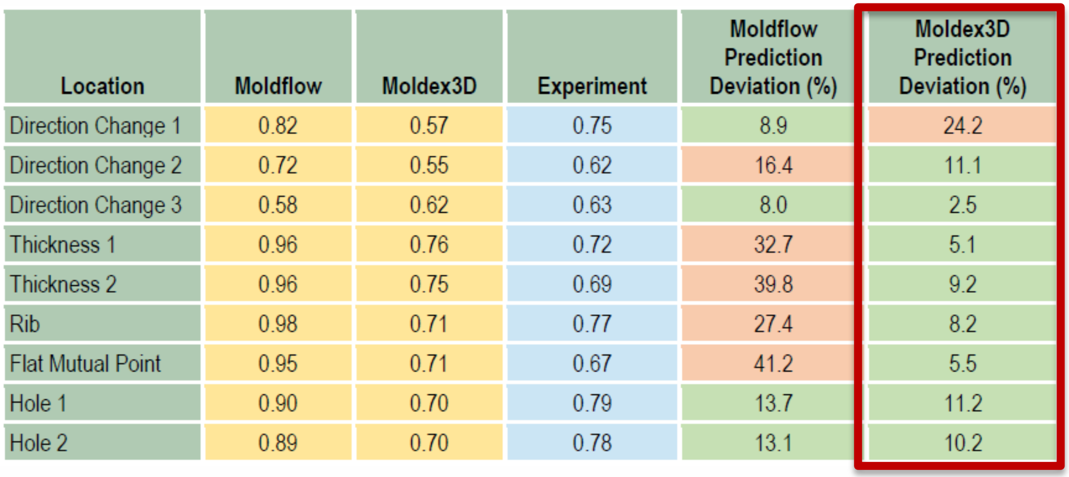
> Seatback
  - **Polyamide with 40% CF**
  - **Most (8/9) predictions satisfied 15% validation criteria**


U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Lighweight Materials
2016 Annual Report

Change in direction - 3 Locations
Change in direction – 3 locations
Hole – 4 locations
Rib – 3 locations
Change in thickness - 3 Locations
Change in thickness – 3 locations
Rib - 3 Locations & Hole - 4 Locations

8/9 (89%) achievement



Location	Moldflow	Moldex3D	Experiment	Moldflow Prediction Deviation (%)	Moldex3D Prediction Deviation (%)
Direction Change 1	0.82	0.57	0.75	8.9	24.2
Direction Change 2	0.72	0.55	0.62	16.4	11.1
Direction Change 3	0.58	0.62	0.63	8.0	2.5
Thickness 1	0.96	0.76	0.72	32.7	5.1
Thickness 2	0.96	0.75	0.69	39.8	9.2
Rib	0.98	0.71	0.77	27.4	8.2
Flat Mutual Point	0.95	0.71	0.67	41.2	5.5
Hole 1	0.90	0.70	0.79	13.7	11.2
Hole 2	0.89	0.70	0.78	13.1	10.2

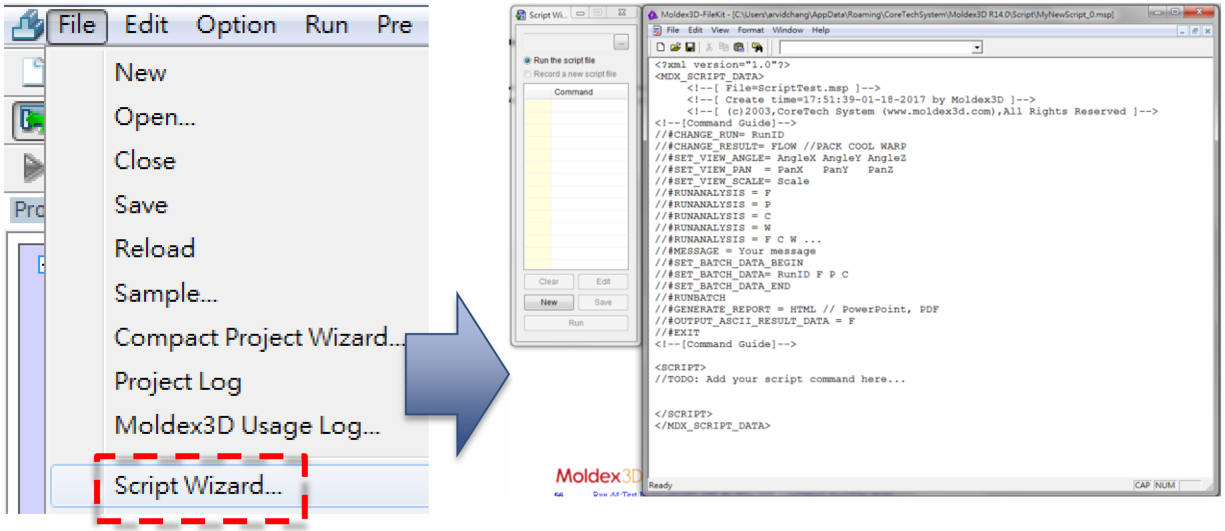
Model – Experiment Comparison of First Eigenvalue of Second Order Orientation Tensor for Polyamide with 40% CF Molded with Low Back Pressure and Slow Fill Speed

Source: US DOE Plan 2017

Simulation Workflow Automation Tool

Advanced Script Wizard

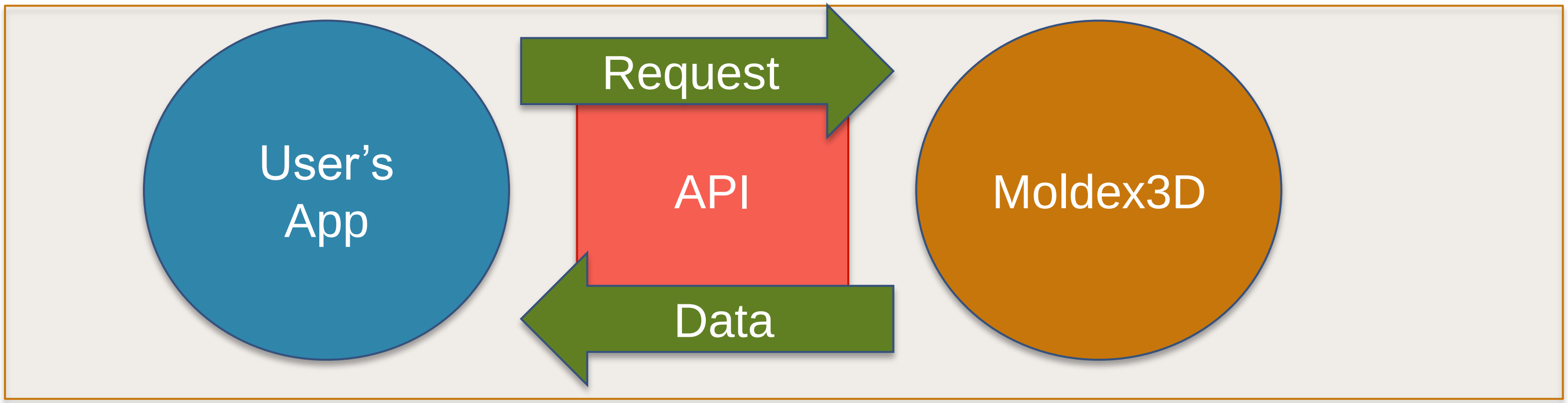
- Embedded function in Moldex3D Project
- No additional license is required
- Available functionality:
  - Switch Run
  - Execute Analysis
  - Output Report
  - Output Max, Min, Avg and SD from the results of F/P/C/W


File
Edit
Option
Run
Pre
New
Open...
Close
Save
Reload
Sample...
Compact Project Wizard...
Project Log
Moldex3D Usage Log...
Script Wizard...
Script Wi...
Run the script file
Record a new script file
Command
Clear
Edit
New
Save
Run
Moldex3D
Moldex3D-FileKit - [C:\Users\arvidchang\AppData\Roaming\CoreTechSystem\Moldex3D R14.0\Script\MyNewScript_0.msp]
File
Edit
View
Format
Window
Help
Ready
CAP
NUM

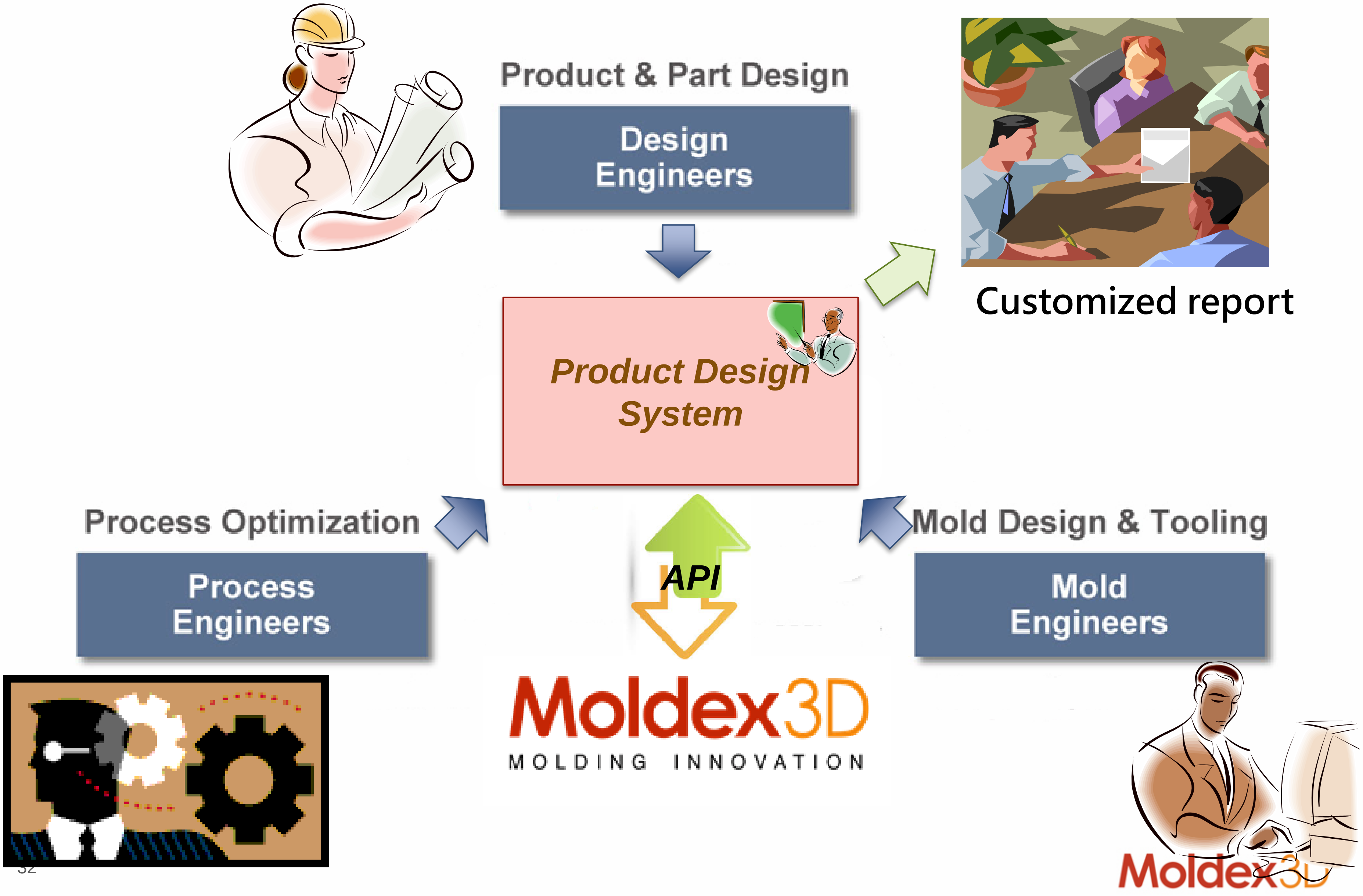
```
<?xml version="1.0"?>
<MDX_SCRIPT_DATA>
     <!--[ File=ScriptTest.msp ]-->
     <!--[ Create time=17:51:39-01-18-2017 by Moldex3D ]-->
     <!--[ (c)2003,CoreTech System (www.moldex3d.com),All Rights Reserved ]-->
<!--[Command Guide]-->
//#CHANGE_RUN= RunID
//#CHANGE_RESULT= FLOW //PACK COOL WARP
//#SET_VIEW_ANGLE= AngleX AngleY AngleZ
//#SET_VIEW_PAN  = PanX   PanY   PanZ
//#SET_VIEW_SCALE= Scale
//#RUNANALYSIS = F
//#RUNANALYSIS = P
//#RUNANALYSIS = C
//#RUNANALYSIS = W
//#RUNANALYSIS = F C W ...
//#MESSAGE = Your message
//#SET_BATCH_DATA_BEGIN
//#SET_BATCH_DATA= RunID F P C
//#SET_BATCH_DATA_END
//#RUNBATCH
//#GENERATE_REPORT = HTML // PowerPoint, PDF
//#OUTPUT_ASCII_RESULT_DATA = F
//#EXIT
<!--[Command Guide]-->

<SCRIPT>
//TODO: Add your script command here...


</SCRIPT>
</MDX_SCRIPT_DATA>
```

Moldex3D API (Application Programming Interface)

- Moldex3D API is in DLL format and compatible with C#
- Moldex3D API license is required
- Available functionality:
  - **Pre-processor**
  - **Post-processor**
  - **Analysis setup application**
  - **Report customization**


User's App
Request
API
Data
Moldex3D

Moldex3D API (Application Programming Interface)



Product & Part Design

Design Engineers

Product Design System

Customized report

Process Optimization

Process Engineers

API

Mold Design & Tooling

Mold Engineers

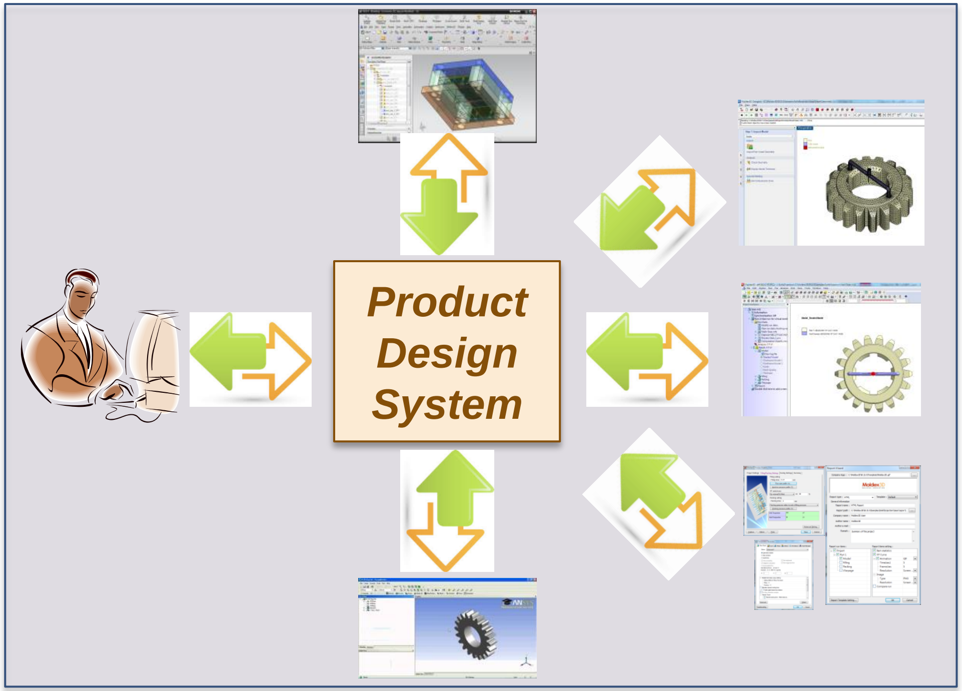
Moldex3D

MOLDING INNOVATION

Moldex3D

API Scenario – Consistent User Interface

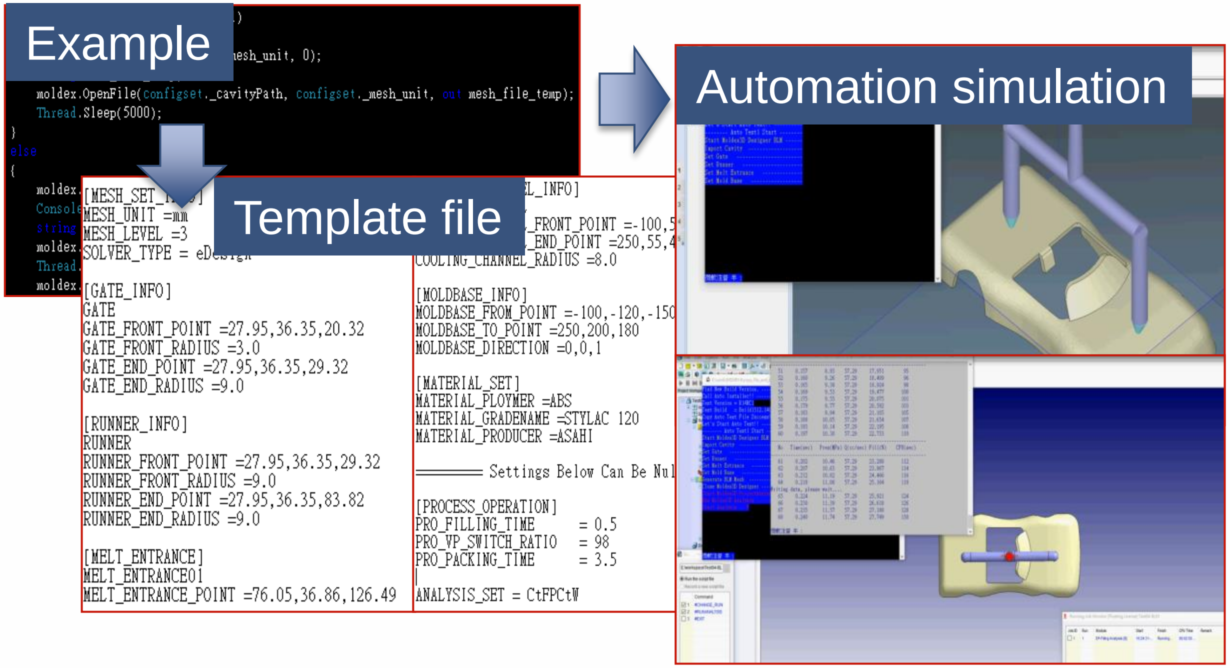
- Construct a consistent user interface in product design
- The system communicate to Moldex3D via API tools
  - Can customize own design workflow
  - Can Integrate with design optimization tools
  - Can reserve key technology
  - Can shorten users' learning curve



Product Design System

API Scenario – Standard Analysis Procedure

- Construct an automatic simulation environment
- There are standard design rules
  - Specify default parameter via template file
  - Automation simulation from meshing, project setup, solving to report generation with single click
  - Avoid human error with Standardized analysis process



```
                            )

                   esh_unit, 0);

    moldex.OpenFile(configset._cavityPath, configset._mesh_unit, out mesh_file_temp);
    Thread.Sleep(5000);
}
else
{
    moldex.
    Console
    string
    moldex.
    Thread.
    moldex.
```

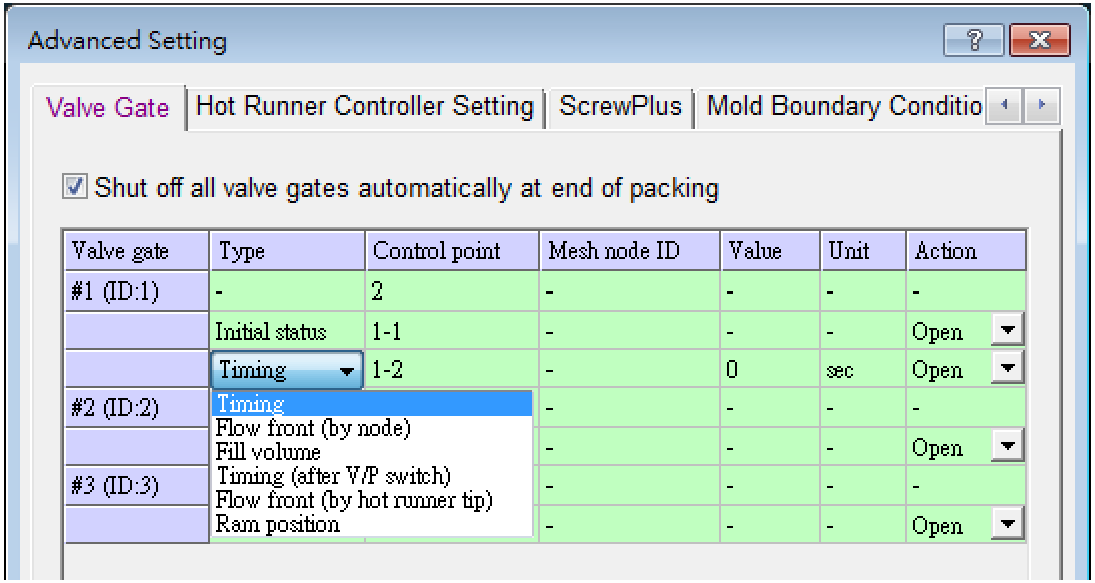
```
[MESH_SET_I
MESH_UNIT =mm
MESH_LEVEL =3
SOLVER_TYPE = eD

[GATE_INFO]
GATE
GATE_FRONT_POINT =27.95,36.35,20.32
GATE_FRONT_RADIUS =3.0
GATE_END_POINT =27.95,36.35,29.32
GATE_END_RADIUS =9.0

[RUNNER_INFO]
RUNNER
RUNNER_FRONT_POINT =27.95,36.35,29.32
RUNNER_FRONT_RADIUS =9.0
RUNNER_END_POINT =27.95,36.35,83.82
RUNNER_END_RADIUS =9.0

[MELT_ENTRANCE]
MELT_ENTRANCE01
MELT_ENTRANCE_POINT =76.05,36.86,126.49
```

```
            EL_INFO]

         _FRONT_POINT =-100,5
         _END_POINT =250,55,4
COOLING_CHANNEL_RADIUS =8.0

[MOLDBASE_INFO]
MOLDBASE_FROM_POINT =-100,-120,-150
MOLDBASE_TO_POINT =250,200,180
MOLDBASE_DIRECTION =0,0,1

[MATERIAL_SET]
MATERIAL_PLOYMER =ABS
MATERIAL_GRADENAME =STYLAC 120
MATERIAL_PRODUCER =ASAHI

======== Settings Below Can Be Nul

[PROCESS_OPERATION]
PRO_FILLING_TIME      = 0.5
PRO_VP_SWITCH_RATIO   = 98
PRO_PACKING_TIME      = 3.5
|
ANALYSIS_SET = CtFPCtW
```

More Enhancements in Solver

Advanced Valve Gate Control

- **Totally 6** control types provided
  - Three additional control types: Fill volume, Timing (after V/P Switch) and Flow front (by hot runner tip)
  - Support mixed type for different control points or valve gates
- Improved usability for control setting
  - Add new option to shut off all valve gates automatically at end of packing in default
  - Initial status can be specified to avoid any misunderstanding

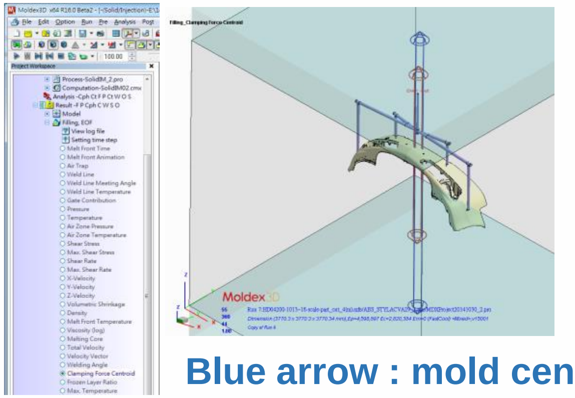

Advanced Setting
?
Valve Gate
Hot Runner Controller Setting
ScrewPlus
Mold Boundary Conditio
Timing
Flow front (by node)
Fill volume
Timing (after V/P switch)
Flow front (by hot runner tip)
Ram position

☑ Shut off all valve gates automatically at end of packing

Valve gate	Type	Control point	Mesh node ID	Value	Unit	Action
#1 (ID:1)	-	2	-	-	-	-
	Initial status	1-1	-	-	-	Open
	Timing	1-2	-	0	sec	Open
#2 (ID:2)			-	-	-	-
			-	-	-	Open
#3 (ID:3)			-	-	-	-
			-	-	-	Open

Advanced Flow to Cavity Consideration

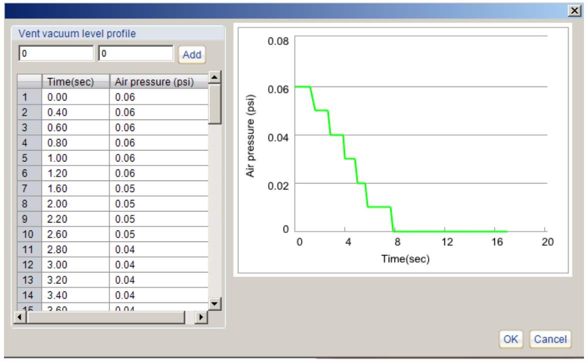
- > **Show Clamping Force Centroid**
  - – **Calculate clamping force centroid all the time and the result indicates the centroid at the moment of clamping force peak**


Moldex3D x64 R16.0 Beta2 - [-(Solid/Injection)-E:\
File Edit Option Run Pre Analysis Post
100.00
Project Workspace
Process-SolidIM_2.pro
Computation-SolidIM02.cmx
Analysis -Cph Ct F P Ct W O S
Result -F P Cph C W S O
Model
Filling, EOF
View log file
Setting time step
○ Melt Front Time
○ Melt Front Animation
○ Air Trap
○ Weld Line
○ Weld Line Meeting Angle
○ Weld Line Temperature
○ Gate Contribution
○ Pressure
○ Temperature
○ Air Zone Pressure
○ Air Zone Temperature
○ Shear Stress
○ Max. Shear Stress
○ Shear Rate
○ Max. Shear Rate
○ X-Velocity
○ Y-Velocity
○ Z-Velocity
○ Volumetric Shrinkage
○ Density
○ Melt Front Temperature
○ Viscosity (log)
○ Melting Core
○ Total Velocity
○ Velocity Vector
○ Welding Angle
● Clamping Force Centroid
○ Frozen Layer Ratio
○ Max. Temperature
Filling_Clamping Force Centroid
Moldex3D
Z

Blue arrow : mold center

Red arrow : clamping force centroid during molding process

- > **Allow tabulated Venting Profile for Detailed air Vent Setting**
  - – **Support vacuum level profile for venting analysis**


Vent vacuum level profile
0
0
Add
0.08
0.06
0.04
0.02
0
Air pressure (psi)
0
4
8
12
16
20
Time(sec)
OK
Cancel

	Time(sec)	Air pressure (psi)
1	0.00	0.06
2	0.40	0.06
3	0.60	0.06
4	0.80	0.06
5	1.00	0.06
6	1.20	0.06
7	1.60	0.05
8	2.00	0.05
9	2.20	0.05
10	2.60	0.05
11	2.80	0.04
12	3.00	0.04
13	3.20	0.04
14	3.40	0.04
15	3.60	0.04

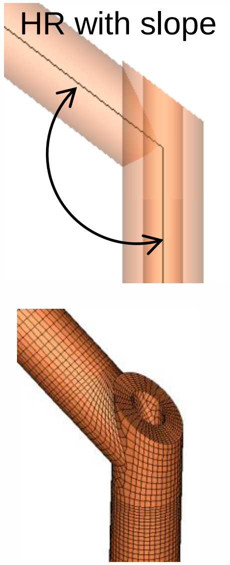
Additional Capability for Different Scenario

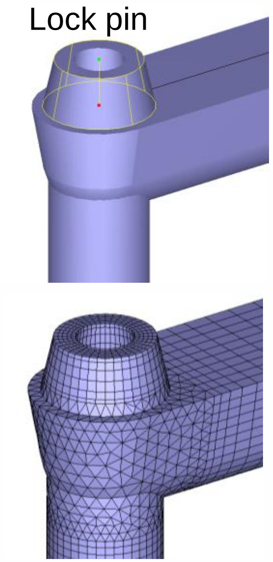
- Resume Calculation
  - Extend the supported process setting mode to machine mode, so all standard process modes support resume
- Multiple Time Steps Output
  - Support to output intermediate results at extend packing stage
- Over-molding Process
  - Support to directly read DYNA-IN file to import the deformed prepreg as an insert for Moldex3D

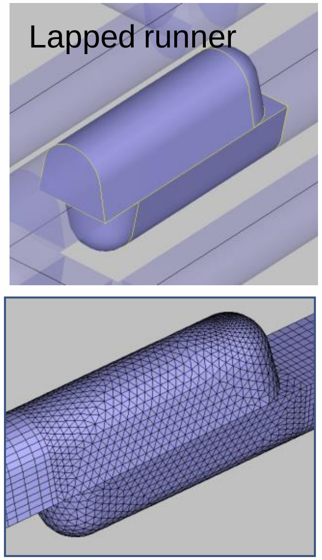
More Enhancements in Pre-processor

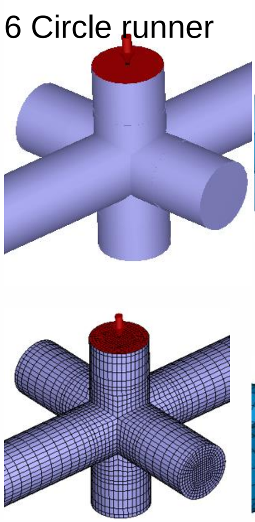
New Format Hexa-Based Solid Mesh

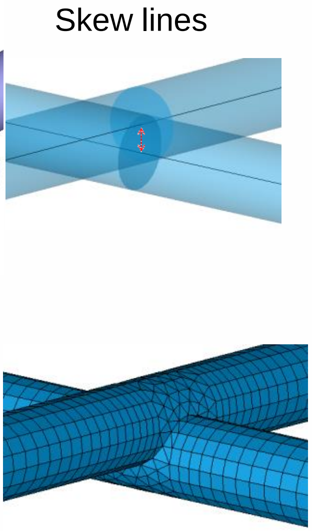
> New and enhanced runner/cooling joints


HR with slope

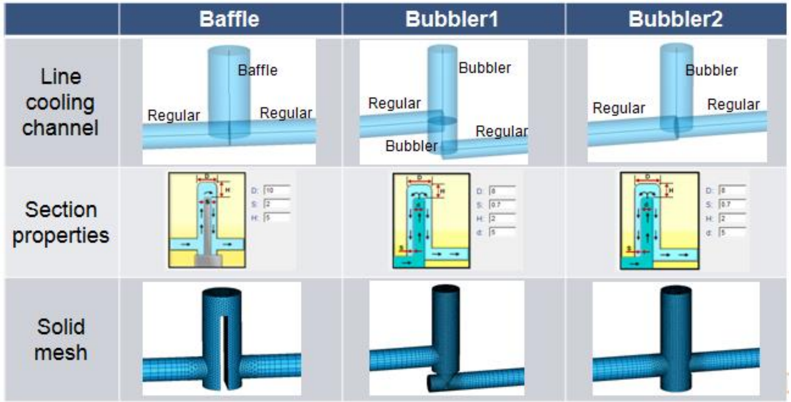

Lock pin


Lapped runner


6 Circle runner


Skew lines

> Support hexa-based baffle and bubbler solid mesh

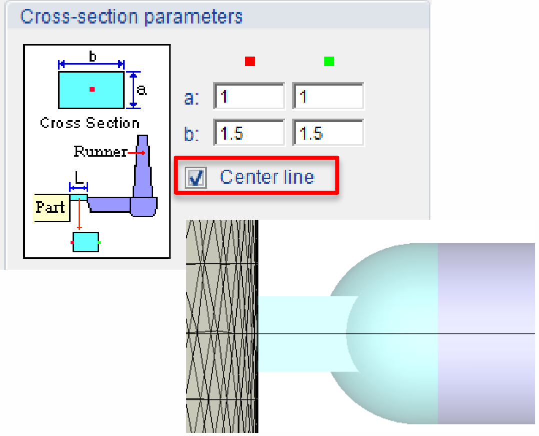


	Baffle	Bubbler1	Bubbler2
Line cooling channel	Regular Baffle Regular	Bubbler Regular Bubbler Regular	Bubbler Regular Regular
Section properties	D: S: H:	D: S: H: d:	D: S: H: d:
Solid mesh			

Flexible Gate Design with Hexa-Based Mesh

> Hexa-based Solid Mesh Kernel

– Support center line and enhance mesh quality in edge/fan gate

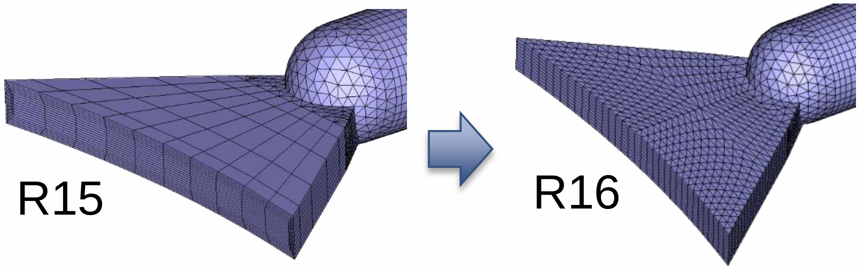


Cross-section parameters

	🟥	🟩
a:	1	1
b:	1.5	1.5

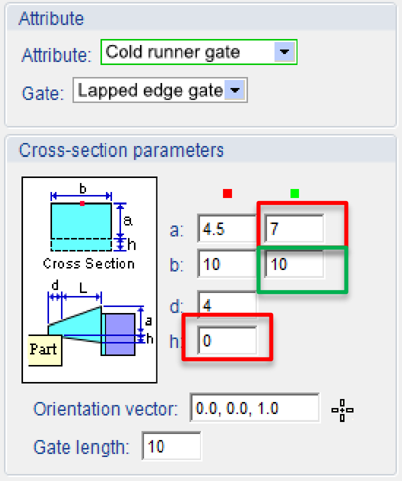
☑ Center line

b
a
Cross Section
Runner
L
Part



In the case with large aspect ratio

– Support more shapes and UI improvements in lapped edge gate



Attribute

Attribute: Cold runner gate

Gate: Lapped edge gate

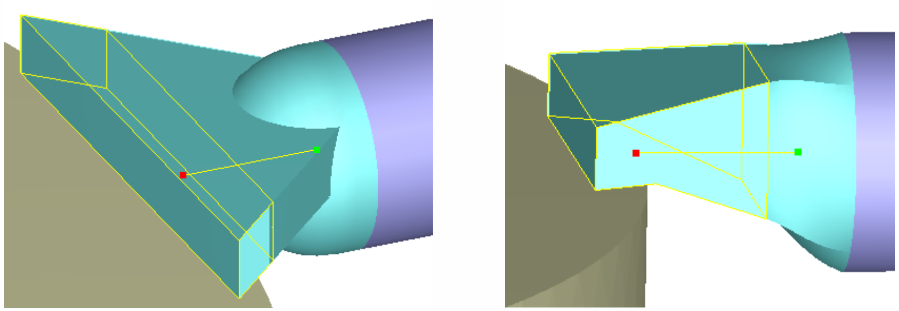
Cross-section parameters

	🟥	🟩
a:	4.5	7
b:	10	10
d:	4	
h:	0	

Orientation vector: 0.0, 0.0, 1.0

Gate length: 10

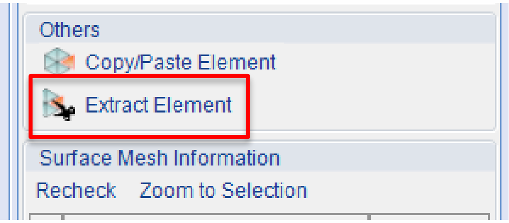
b
a
h
Cross Section
d
L
a
h
Part

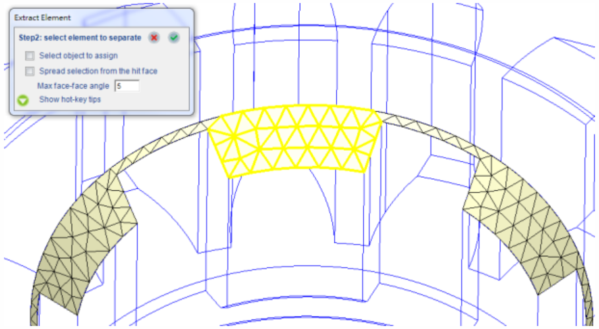


Enhanced BLM Kernel for Surface Mesh

> ## Advanced Surface Mesh Preparation Tools

- Transform functions like copy, move, rotate... are now activated in fix surface mesh mode
- Extract element function is added in fix surface mesh mode


Others
Copy/Paste Element
Extract Element
Surface Mesh Information
Recheck
Zoom to Selection


Extract Element

Step2: select element to separate

☐ Select object to assign

☐ Spread selection from the hit face

Max face-face angle 5

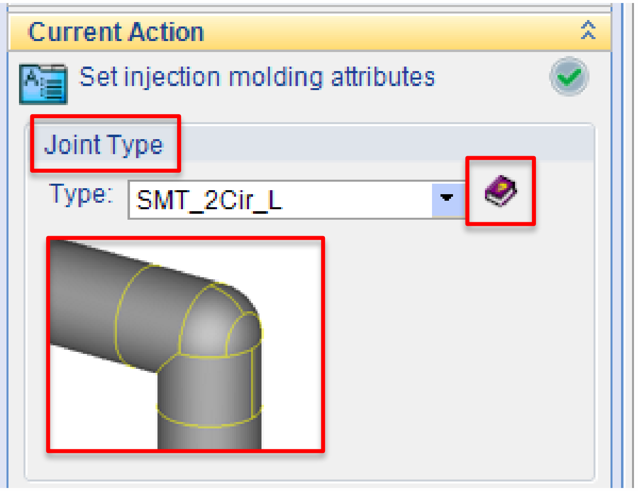
Show hot-key tips

> ## Improved Surface Mesh Generation Kernel

- Surface/solid mesh generator kernel enhancement for better performance, quality and less element
- Improve data transfer for symmetry volume calculation
- Add moving surface BC in Set Face BC function

Enhanced BLM Kernel for Solid Mesh

> **Joint Type Function UI Enhancement**
  - **On-line help quick link provided**
  - **Change model color in the diagram**
  - **Utilize term Joint type, instead of Node type, for better understanding**

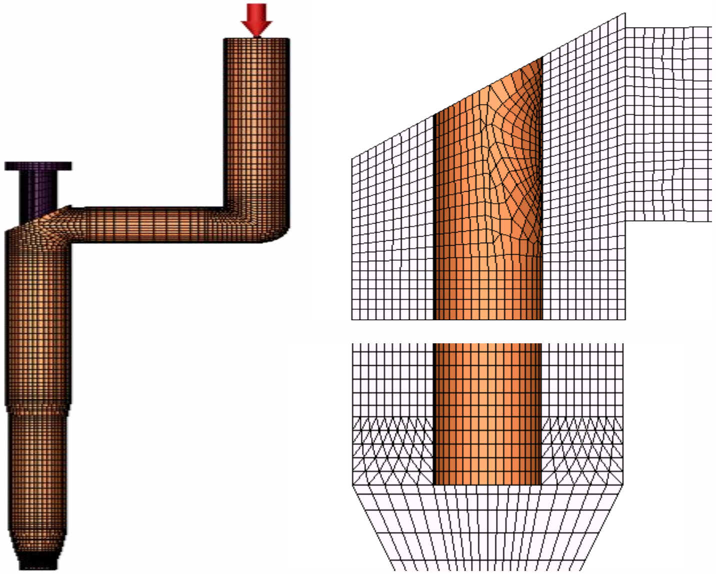


Set injection molding attributes

Joint Type

Type: SMT_2Cir_L

> **Hot Runner Mesh Generation**
  - **Refined mesh in annular layer**
  - **Automatic solid mesh generation for stroke and for pin movement simulation**



Enhanced Material Wizard with New Models

- Add new PvTC model: Two domain modified Tait
  - Extended from Modified Tait Model (2) to consider conversion variation effect
- Add new viscosity model: Cross CastroMacosko Model (1)
  - Extended from Cross CastroMacosko model to observe increased viscosity with low shear zone
- Enhance Material Wizard Usability:
  - Modify history, information resource, search window size

Expanded Modeling Database

- New and Updated Material to Database
  - 31 thermoplastic materials are newly added
    - COC(2), LCP(4), PBT(2), PPS(3), PA(19), PK(1)
  - 0 thermo-set materials are newly added
  - 11 material information is updated for properties including viscosity, PvT, Cp and K

- New Injection Machine
  - Billion: 367 different machines from GM, HERCULE, SELECT series
  - Toshiba: 63 different machines from EC-S series

- Machine Mode Process Setting
  - Enable Maximum injection pressure from Classic mode to Simple mode
  - Support Machine Interface for 百塑 machines

More Enhancements in UI

Enhance Analysis Post-processing Capability

- [Fiber] Improve sketch performance of Fiber result item
- [Cool] Allow to show node information on cooling channel by Selection
- [Project] Allow history curve plotting for result in different time steps
- [Project] Allow result plotting for thickness direction distribution with multiple time steps
- [Project] Support model rotation with local coordinate system
- [Project] Support clipping function together with warpage scale
- [Project] Allow select function applied to part insert nodes

Allow More Flexibility for Project Management

- [Project] Preserve remark for copied or exported run
- [Project] Add option to show/hide run remark with XY Curve result
- [Project] Allow rename when exporting run as a new project
- [Project] Merge eDesign project (MVJ) into Solid (M3J)
- [Report] Add customized summary page in PPT report

Enhanced User Experience for SYNC Simulation

- Improved SYNC usability to run simulation on CAD
  - [SYNC] Add maximum injection pressure as process condition
  - [SYNC] Allow to skip project type selection

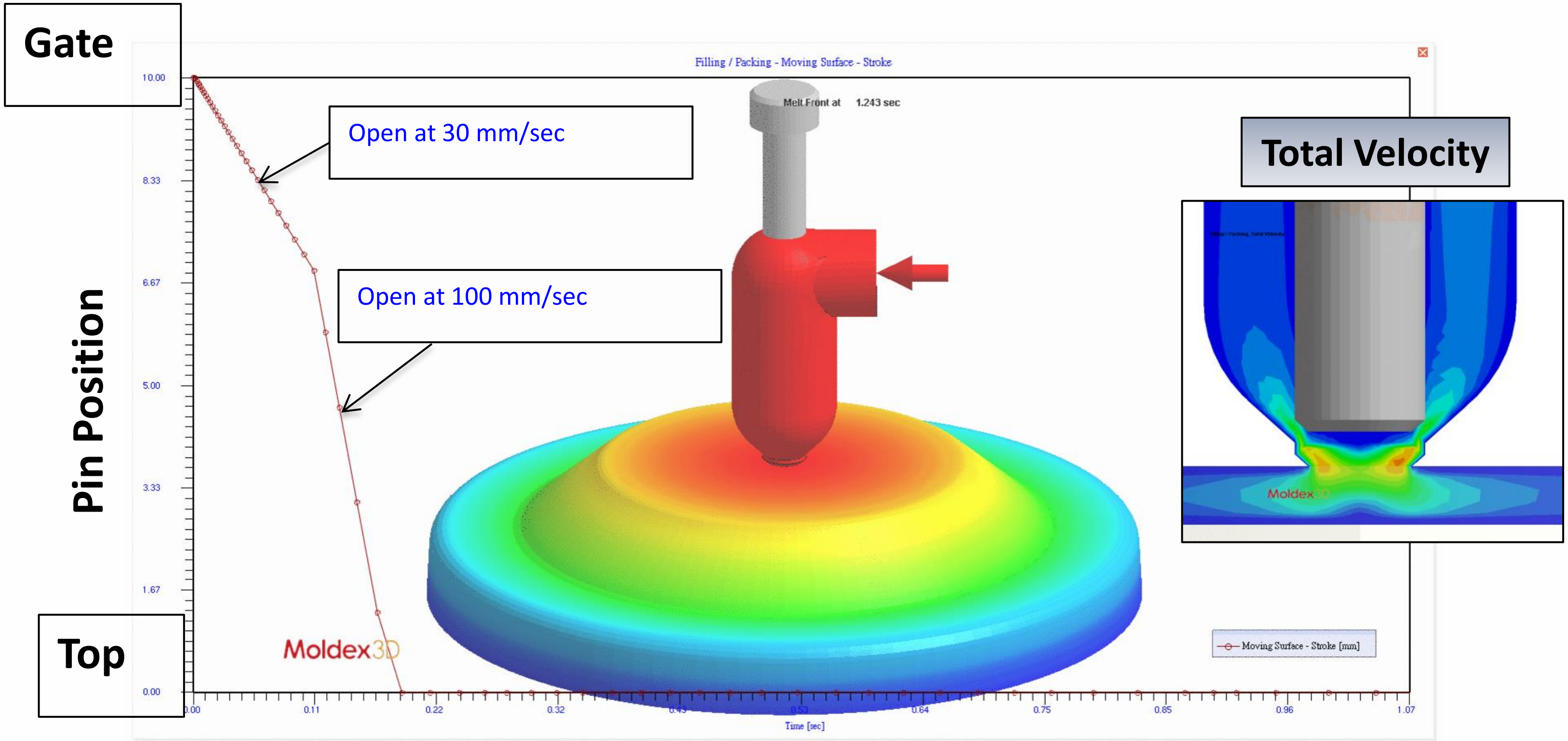
- Renewed SYNC UI and workflow with CAD style
  - Include style of NX, Creo and SolidWorks
  - Include UI of Parting Direction, Symmetry Ratio, Report Wizard, Modify Runner, Analysis, Plotting setting

Enhancements in Solution Add-On

Advanced Hot Runner (AHR)

> **Pin Movement Simulation**

- **Realistic approach to take valve pin position and movement into account of melt flow behavior simulation**

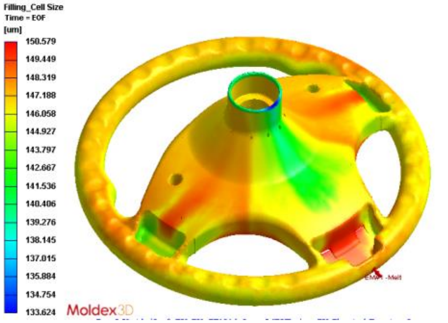


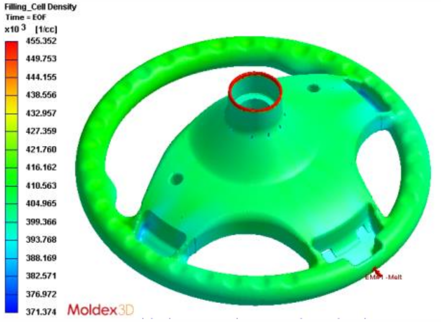
Open at 30 mm/sec

Open at 100 mm/sec

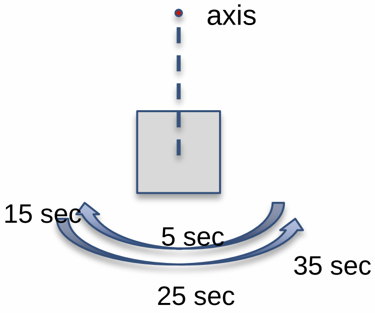
Chemical Foaming Molding (CFM)

- Predict the distribution of Cell size & cell density
  - PU foaming process simulation provides new capability for estimating/calculating cell size and cell density


Filling_Cell Size
Time = EOF
[um]
150.579
149.449
148.319
147.188
146.058
144.927
143.797
142.667
141.536
140.406
139.276
138.145
137.015
135.884
134.754
133.624
EMPI -Melt
Moldex3D


Filling_Cell Density
Time = EOF
x10 3 [1/cc]
455.352
449.753
444.155
438.556
432.957
427.359
421.760
416.162
410.563
404.965
399.366
393.768
388.169
382.571
376.972
371.374
EMPI -Melt
Moldex3D

- Support oscillating rotation simulation
  - Consider foaming front influenced by oscillating rotation effect



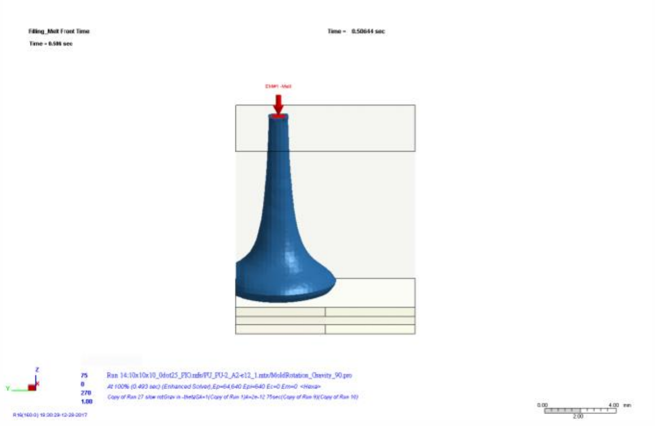
axis

15 sec

5 sec

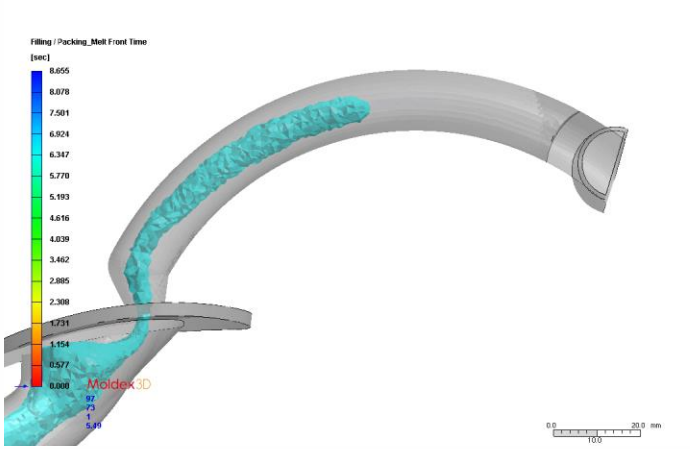
35 sec

25 sec

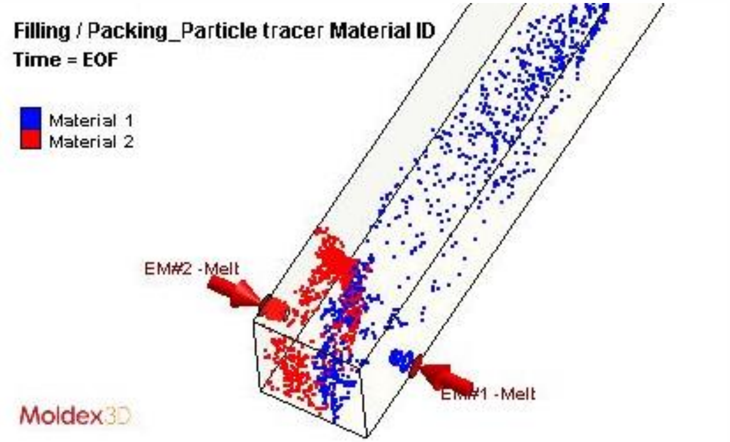

Filling_Melt Front Time
Time = 0.506 sec
Time = 0.50644 sec
EMPI -Melt

Fluid-Assisted Injection Molding (FAIM)

- Water-Assisted Injection Molding (WAIM)
  - Support simulation of push-back, a technique process in full-shot process to avoid the switchover mark and material waste

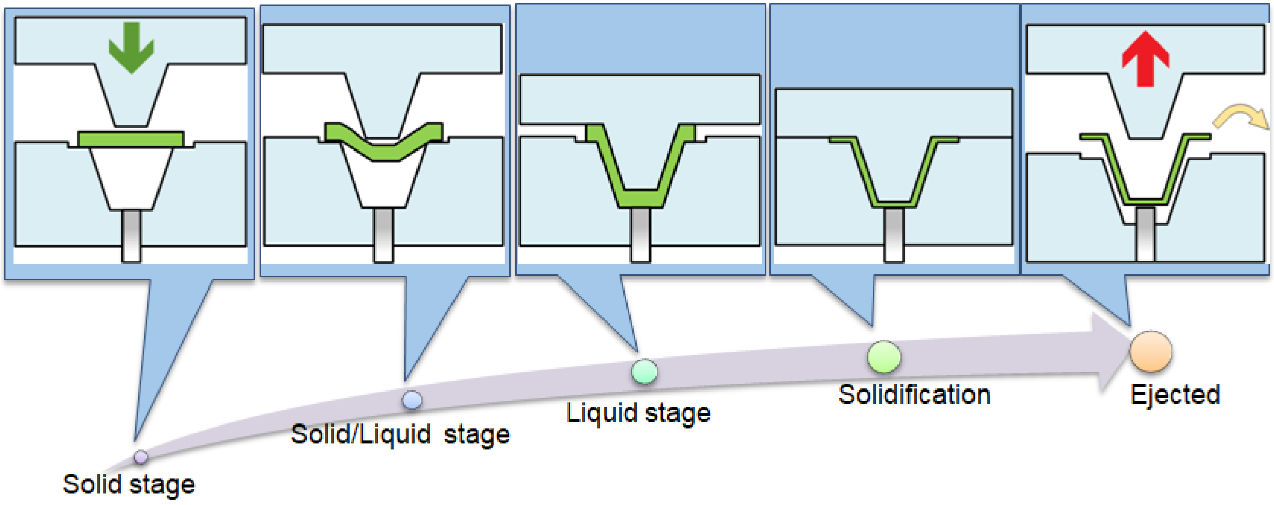

Filling / Packing_Melt Front Time
[sec]
8.655
8.078
7.501
6.924
6.347
5.770
5.193
4.616
4.039
3.462
2.885
2.308
1.731
1.154
0.577
0.000
Moldex3D
0.0
20.0 mm
10.0

- Support Particle Tracer by materials for BiIM & CoIM


Filling / Packing_Particle tracer Material ID
Time = EOF
🟦 Material 1
🟥 Material 2
EM#2 -Melt
EM#1 -Melt
Moldex3D

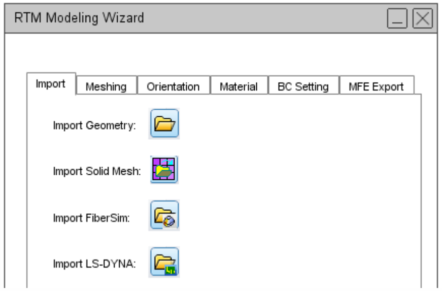
Compression Molding (CM)

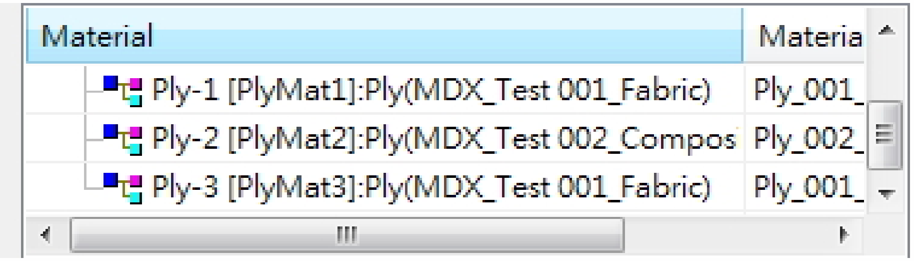
- Enhancements in Charge Deformation from LS-DYNA
  - Numerical stability is improved in solid stage
  - Gravity effect & air convection in solid stage are considered
  - A format of LS-DYNA results is output in addition to LS file
- Integration in 3rd Party Solver
  - Optimize the integration workflow to import initial charge shape, temperature distribution and fiber orientation data easier


Solid stage
Solid/Liquid stage
Liquid stage
Solidification
Ejected

Resin Transfer Molding (RTM)

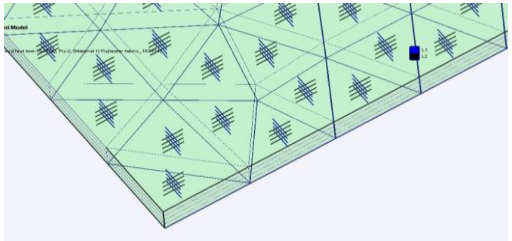
- RTM Pre-processor
  - Develop RTM wizard to help users to import draping data, generate mesh, and specify ply groups, BC and material groups

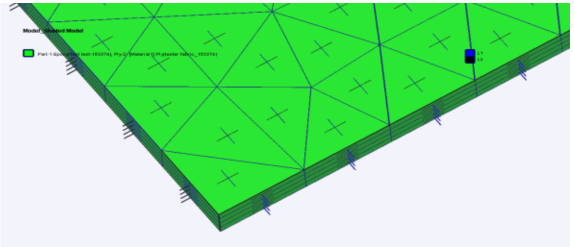

RTM Modeling Wizard
Import
Meshing
Orientation
Material
BC Setting
MFE Export
Import Geometry:
Import Solid Mesh:
Import FiberSim:
Import LS-DYNA:



Material	Materia
Ply-1 [PlyMat1]:Ply(MDX_Test 001_Fabric)	Ply_001_
Ply-2 [PlyMat2]:Ply(MDX_Test 002_Compos	Ply_002_
Ply-3 [PlyMat3]:Ply(MDX_Test 001_Fabric)	Ply_001_

- Ply Material
  - Permeability property for each material group
- Ply Orientation Display
  - Ply orientation for all elements or skin only

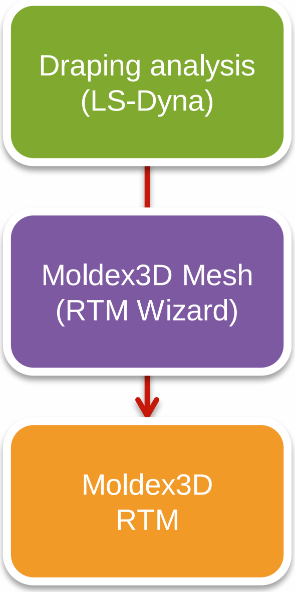




Resin Transfer Molding (RTM)

> Draping Effect

- The draping result can be imported into Moldex3D Mesh during mesh preparation and the analysis result will be affected by considering the draping effect

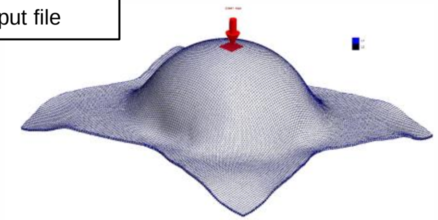


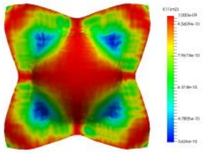
Draping analysis (LS-Dyna)

Moldex3D Mesh (RTM Wizard)

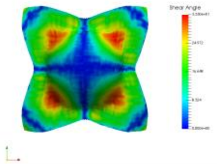
Moldex3D RTM

Import ply orientation LS-Dyna input file

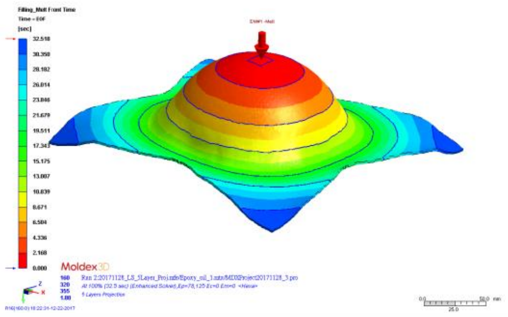




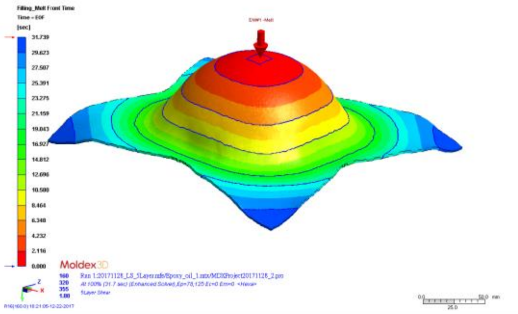
Permeability



Shear Angle



W/O the effect of draping

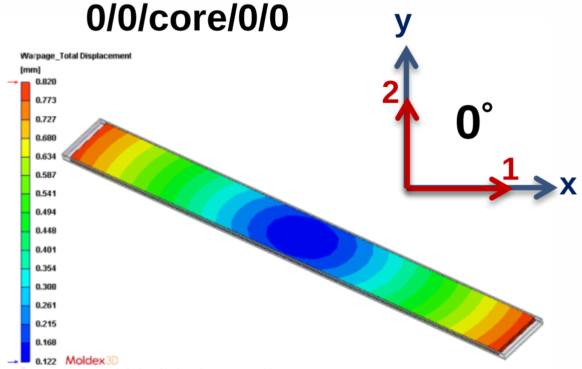


With the effect of draping

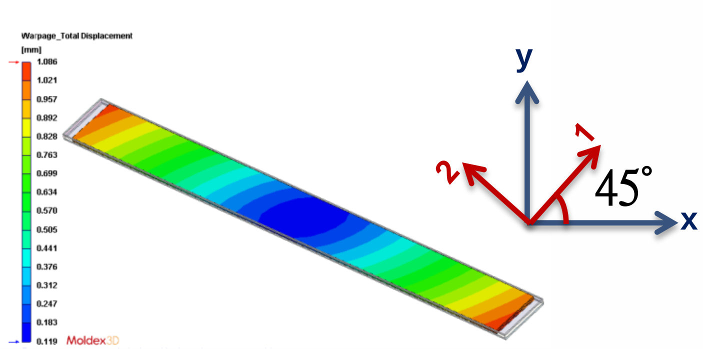
Resin Transfer Molding (RTM)

> **Warpage analysis**
  - **Support warpage with consideration of fiber mat orientation**
  - **Multi-layer composite structure property is calculated with multi-component module**

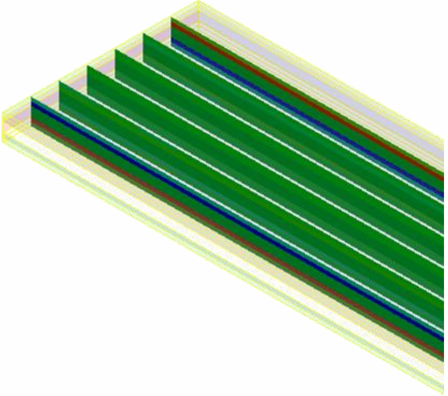
0/0/core/0/0



45/45/core/45/45



  - **3D simulation to show the stress difference between layers in micro-structure.**

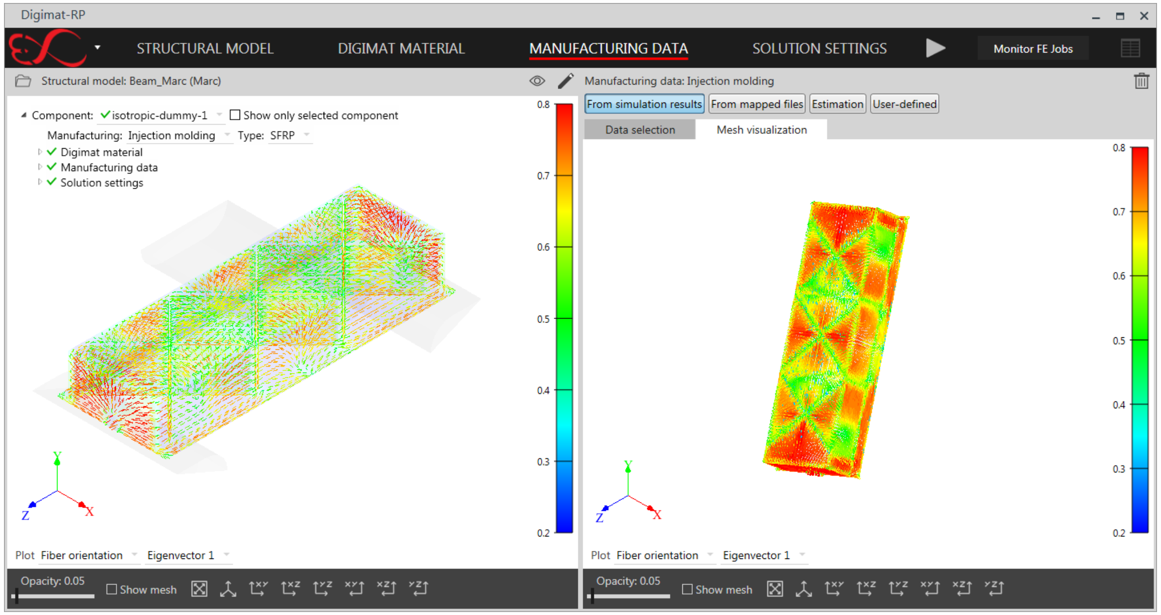


Optics, Expert, FEA Interface

- Optics simulation with Improve post-processing capability
  - Apply nm for Retardation result of Optics analysis
  - Support Clip, Slicing and IsoSurface function for Optics result
- Expert flexible optimization analysis and task
  - Add option to stop all batch runs when one failed
  - DOE support matrix mode setting and analysis
  - Support optimization with PvT result of multiple sensor nodes
- FEA Interface to allow more data transfer
  - 3D-to-Shell data mapping for ABAQUS
  - part insert temperature output

CADdoctor, Digimat-RP

- Moldex3D CADdoctor to support latest CAD version
  - Parasolid V29.1
- Upgrade Digimat-RP from 2017.1 to 2018.0 in Moldex3D
  - Update for new user interface
  - Support weld line strength analysis



Structural model: Beam_Marc (Marc)

Component: ✓isotropic-dummy-1 ☐ Show only selected component

Manufacturing: Injection molding Type: SFRP

Manufacturing data: Injection molding

Plot Fiber orientation Eigenvector 1

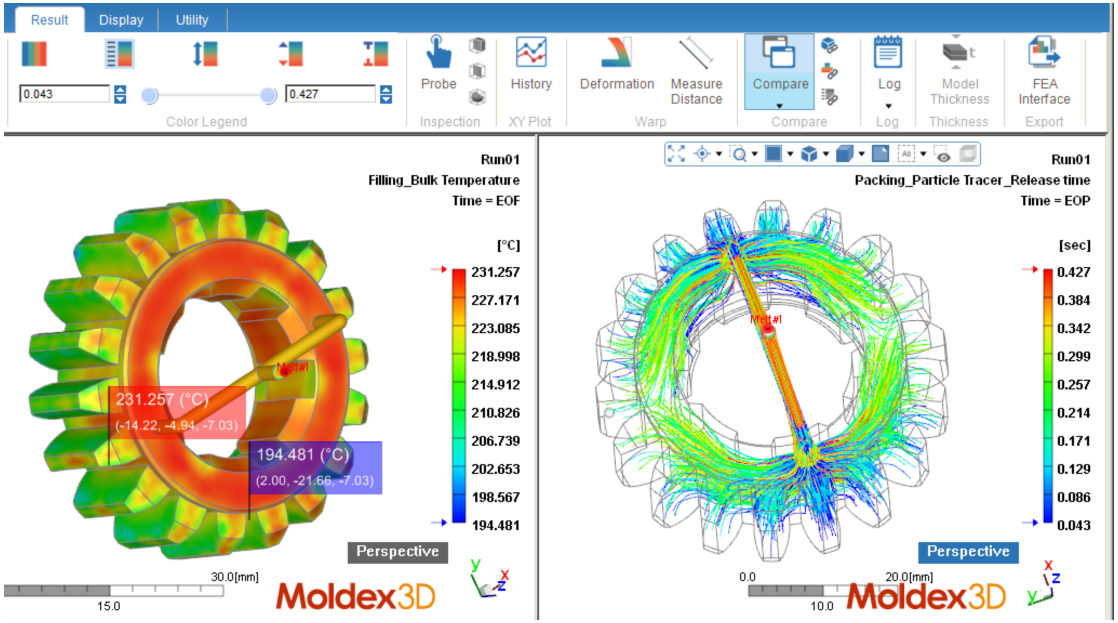
Opacity: 0.05 ☐ Show mesh

Digimat-RP
STRUCTURAL MODEL
DIGIMAT MATERIAL
MANUFACTURING DATA
SOLUTION SETTINGS
Monitor FE Jobs
✓ Digimat material
✓ Manufacturing data
✓ Solution settings
From simulation results
From mapped files
Estimation
User-defined
Data selection
Mesh visualization
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Y
Z
X

Enhancements in Moldex3D Studio (Beta)

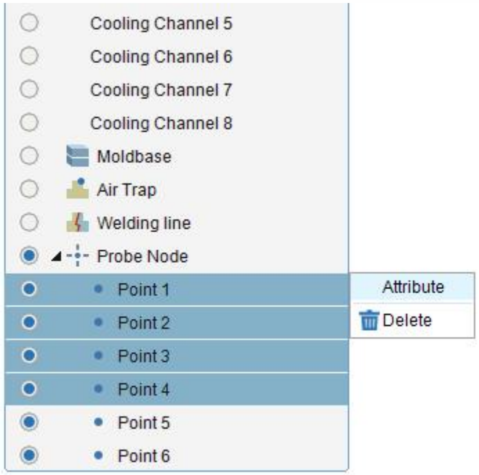
Improved Usability of Analysis Preparation

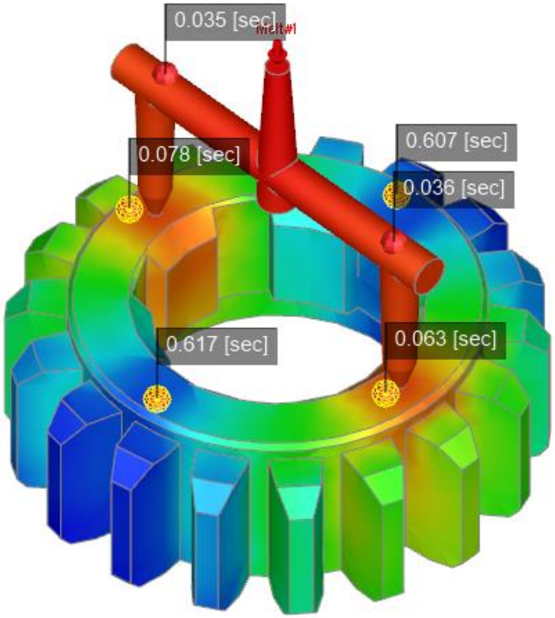
- Improve Model Tree function for better group, appearance
- Support multi-language UI (Language Packs) and unit switch
- Allow customized platform setting for user preference
- Support Max/Min tooltips in display window and color legend
- Enhance Tree function and provide run setting summary


Result
Display
Utility
0.043
0.427
Color Legend
Probe
Inspection
History
XY Plot
Deformation
Measure Distance
Warp
Compare
Compare
Log
Log
Model Thickness
Thickness
FEA Interface
Export
Run01
Filling_Bulk Temperature
Time = EOF
[°C]
231.257
227.171
223.085
218.998
214.912
210.826
206.739
202.653
198.567
194.481
231.257 (°C)
(-14.22, -4.94, -7.03)
194.481 (°C)
(2.00, -21.66, -7.03)
Melt#1
Perspective
30.0[mm]
15.0
Moldex3D
Run01
Packing_Particle Tracer_Release time
Time = EOP
[sec]
0.427
0.384
0.342
0.299
0.257
0.214
0.171
0.129
0.086
0.043
Melt#1
Perspective
0.0
20.0[mm]
10.0
Moldex3D

More Assistant Tools for Better Project Management

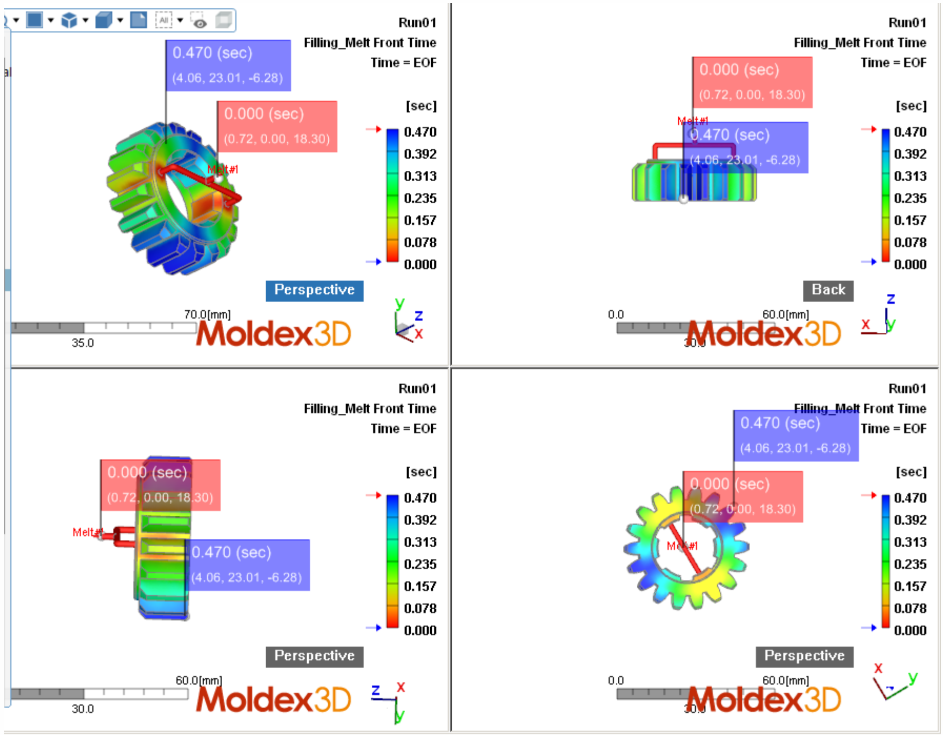
- Add Animation Wizard and Video generator to manage animation display and video generation
- Utilize Probe Node to replace Measure Node to display the local information of model and analysis result
- Support Result Advisor and two-point distance measurement


○ Cooling Channel 5
○ Cooling Channel 6
○ Cooling Channel 7
○ Cooling Channel 8
○ Moldbase
○ Air Trap
○ Welding line
● Probe Node
● Point 1
● Point 2
● Point 3
● Point 4
● Point 5
● Point 6
Attribute
Delete


0.035 [sec]
Melt#1
0.078 [sec]
0.607 [sec]
0.036 [sec]
0.617 [sec]
0.063 [sec]

More Assistant Tools for Better Project Management

- Support snapshot (Hot key: Ctrl+P) and multiple display window for different runs and results: sync of result items, legend range and view
- Allow run management with function to copy, delete, export and clear

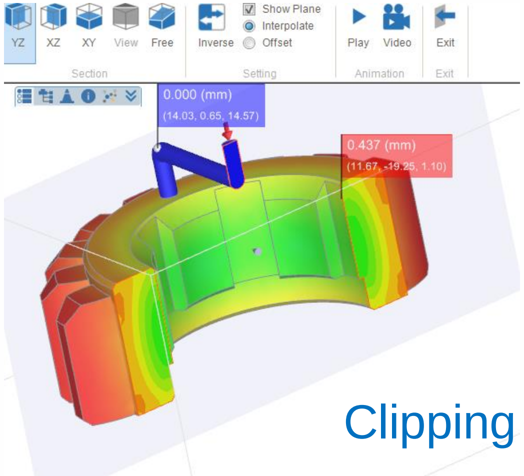

Run01
Filling_Melt Front Time
Time = EOF
0.470 (sec)
(4.06, 23.01, -6.28)
0.000 (sec)
(0.72, 0.00, 18.30)
Melt#1
[sec]
0.470
0.392
0.313
0.235
0.157
0.078
0.000
Perspective
Back
70.0[mm]
60.0[mm]
35.0
30.0
0.0
Moldex3D
x
y
z

Enhanced Simulation Capability

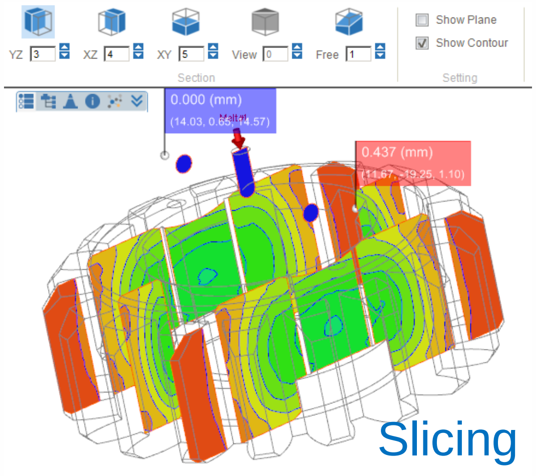
- Support more functions such for Multi-Component Molding and FEA Interface modules
- Support result plotting of history curve with multiple time steps and allow to add label and adjust range in XY Plot
- Support Cloud Computing and to launch Computing Manager before summiting jobs
- Support Space Mouse, different screens and DPI scenario
- Allow to import different format CAD files in the same time and continue the run setting with Project

Improved post-processing performance

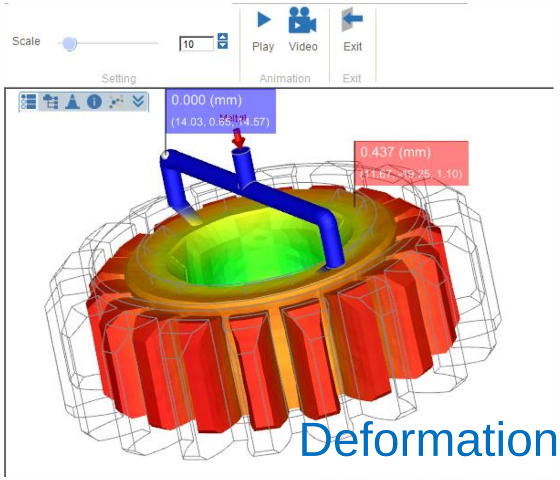
- Improve vector sketch efficiency for Fiber and Velocity result
- Support to export PPT format report
- Display scaled deformation for Warpage and Sink mark Result
- Improve display efficiency on Clipping function
- Display model thickness on part solid mesh entities


YZ
XZ
XY
View
Free
Section
Inverse
☑ Show Plane
● Interpolate
○ Offset
Setting
Play
Video
Animation
Exit
Exit
0.000 (mm)
(14.03, 0.65, 14.57)
0.437 (mm)
(11.67, -19.25, 1.10)

Clipping


YZ 3
XZ 4
XY 5
View 0
Free 1
Section
☐ Show Plane
☑ Show Contour
Setting
0.000 (mm)
(14.03, 0.65, 14.57)
0.437 (mm)
(11.67, -19.25, 1.10)

Slicing


Scale
10
Setting
Play
Video
Animation
Exit
Exit
0.000 (mm)
(14.03, 0.65, 14.57)
0.437 (mm)
(11.67, -19.25, 1.10)

Deformation

Moldex3D

MOLDING INNOVATION

www.moldex3d.com

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