Moldflow Mondays - Round 2

Exploring Advanced Concepts, Workflows, and Best Practices

Mason V Myers
Principal Implementation Consultant

Introduction to Mason

Beaumont

LORD

AUTODESK

AUTODESK
Moldflow Insight
CERTIFIED EXPERT

Autodesk Moldflow Certification

Associate

- 60 questions
- 2 hours
- Now Online

AUTODESK Moldflow Insight
CERTIFIED ASSOCIATE

Professional

- 110 Questions
- Mesh a part
- Create Runner
- Model Cooling/Inserts
- 144 Additional Questions
- 8-10 hours

AUTODESK Moldflow Insight
CERTIFIED PROFESSIONAL

Expert

- Professional for 1 year
- 144 Questions
- Mesh Clean Up
- Fix a Warpage Problem
- 120 Additional Questions
- 3.5 Days

AUTODESK Moldflow Insight
CERTIFIED EXPERT

MoldflowCertification@Autodesk.com

Moldflow Mondays

Happy Moldflow Monday!

Part CAD vs Tool CAD - what's the difference and which one should we be using in Moldflow?

Part CAD - I would define this as the desired or designed molded part shape and size. Typically this would be the starting point for our simulation work.

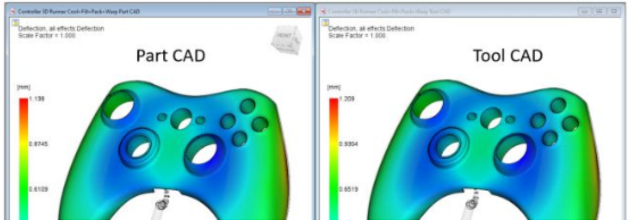
Tool CAD - I would define this model as the grown, or larger, CAD that would represent the tool negative. We would use the shrink rates to increase the size of the Part CAD to generate this model. Ultimately, the Tool CAD would be used to cut the mold cavity.

I think the best approach would be to start with Part CAD to answer early questions like gate location, runner size, and processing conditions. Once cooling is added and shrink rates have been established, your final simulation should probably be using Tool CAD.

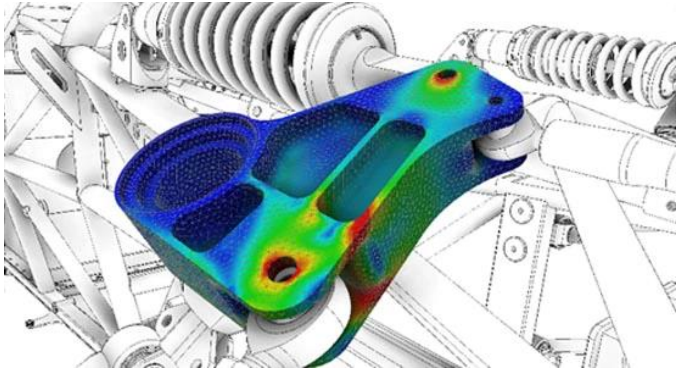
If you are trying to match deflection from actual molded samples, simulating the Tool CAD would give you the most accurate comparison.

Do you use Part CAD or Tool CAD in your Moldflow simulations?

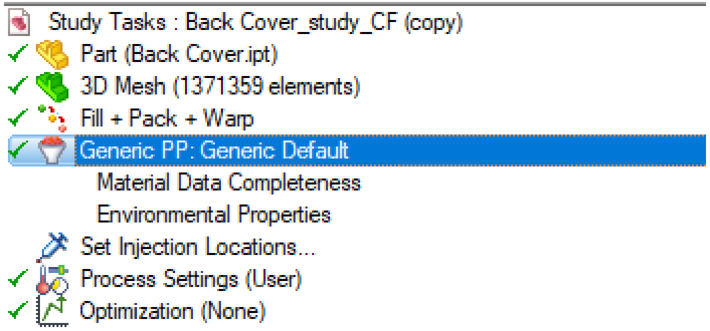
#moldflow #autodesk #autodeskemployee #tooling #injectionmolding

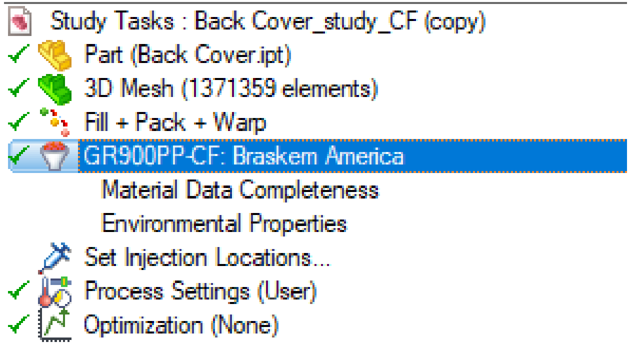


Simulation Matching Reality



Material Selection





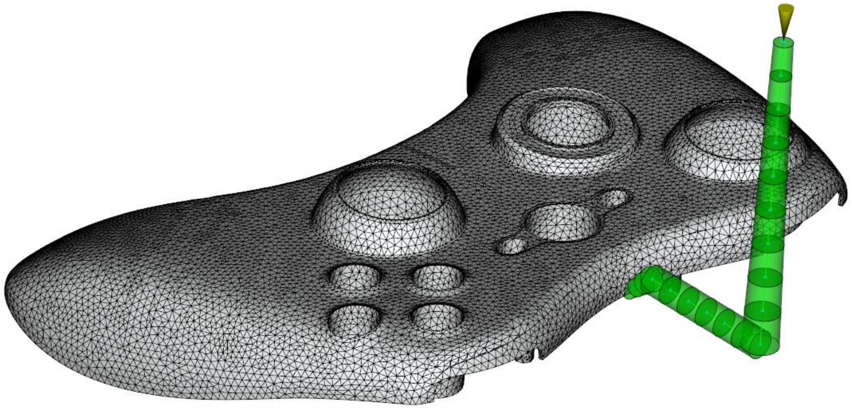
Substitute Material

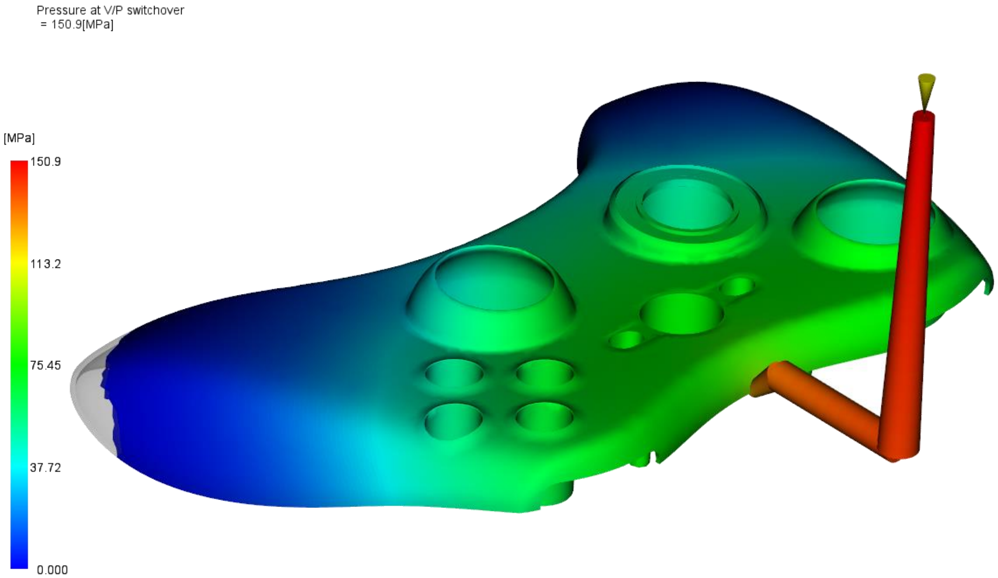
Actual Material

Juncture Loss

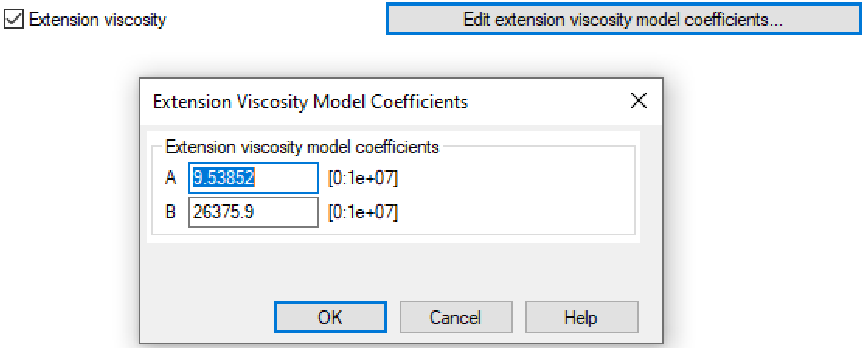
Juncture loss method coefficients

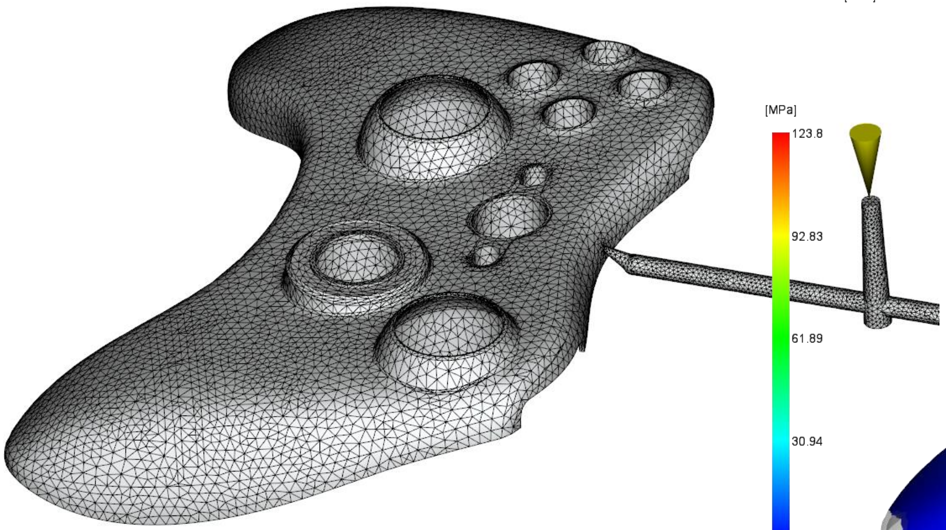
c1	0.006	Pa^(1-c2)
c2	1.6	

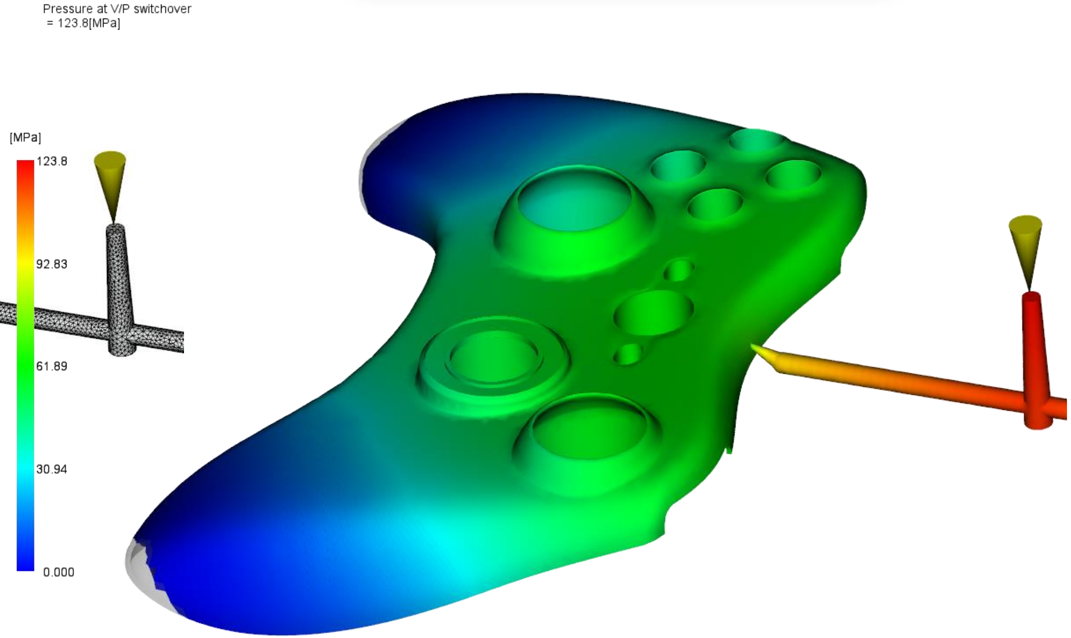




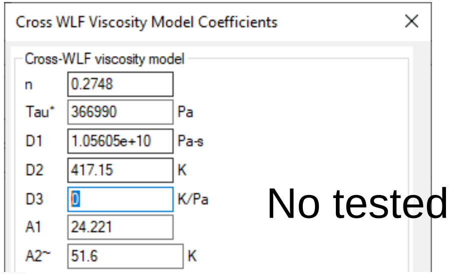
Extensional Viscosity



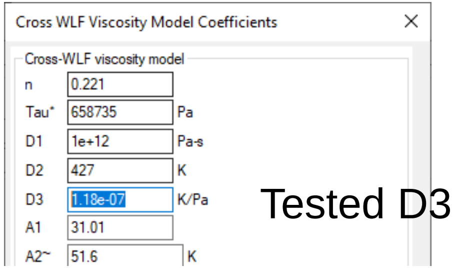




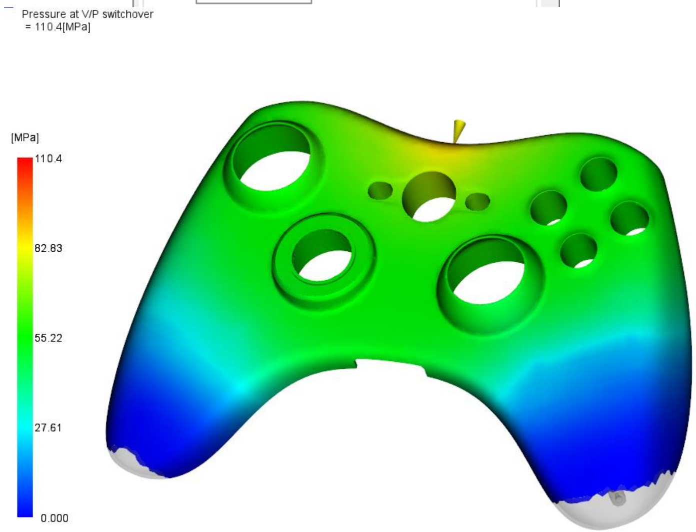
D3 Values

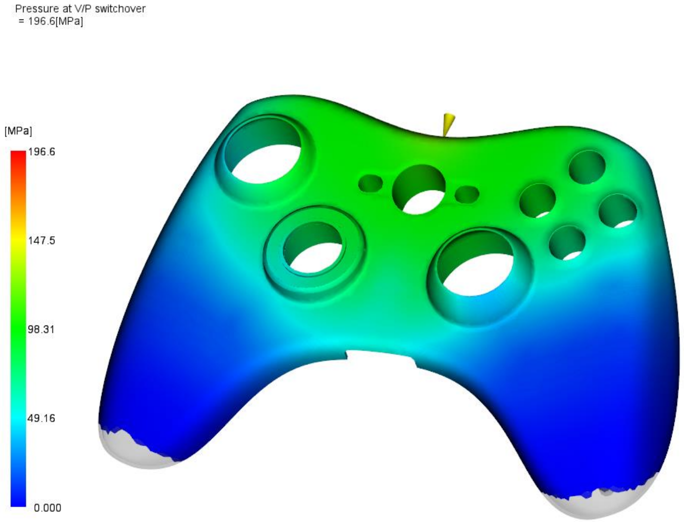


No tested D3 value

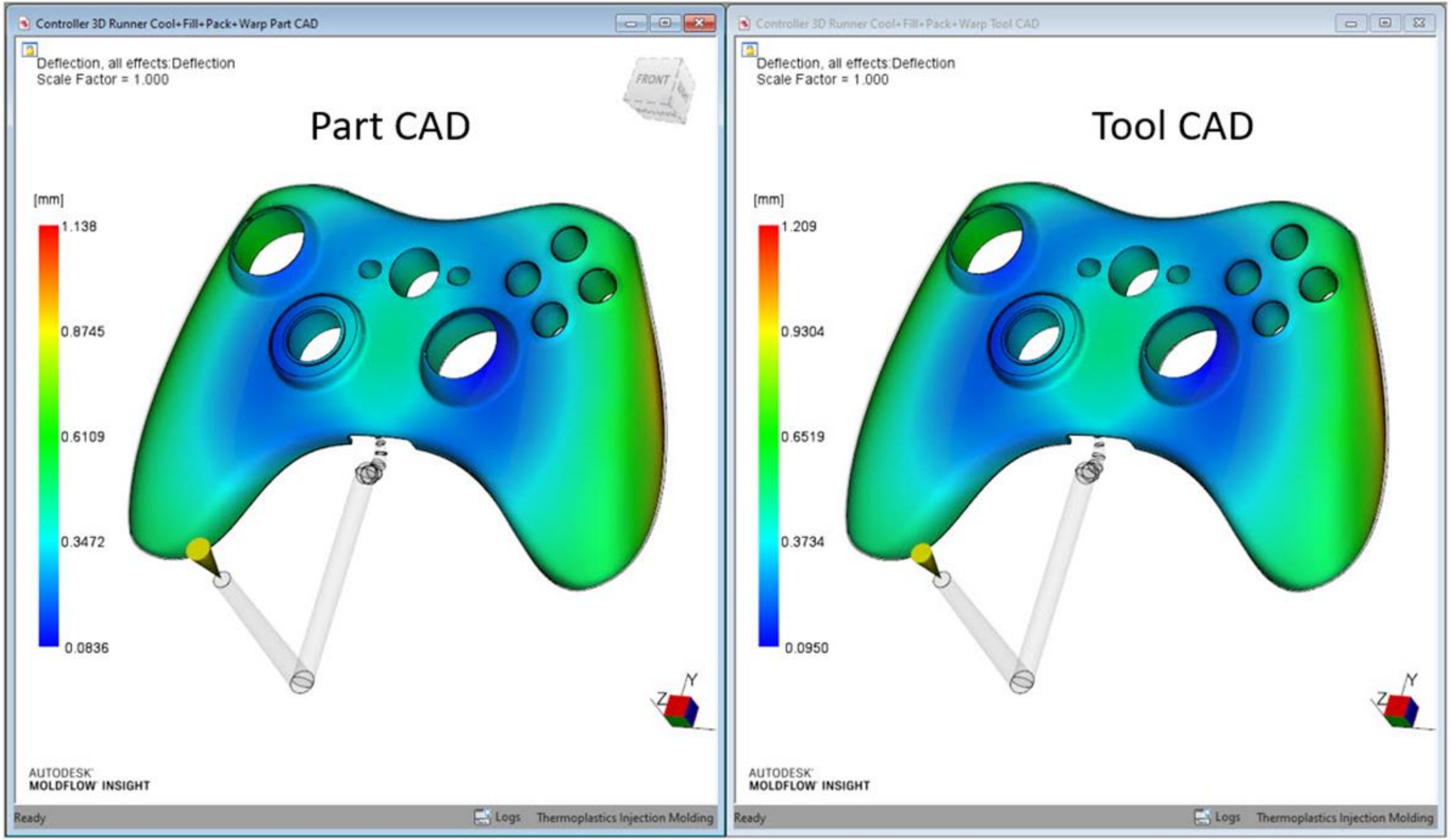


Tested D3 value



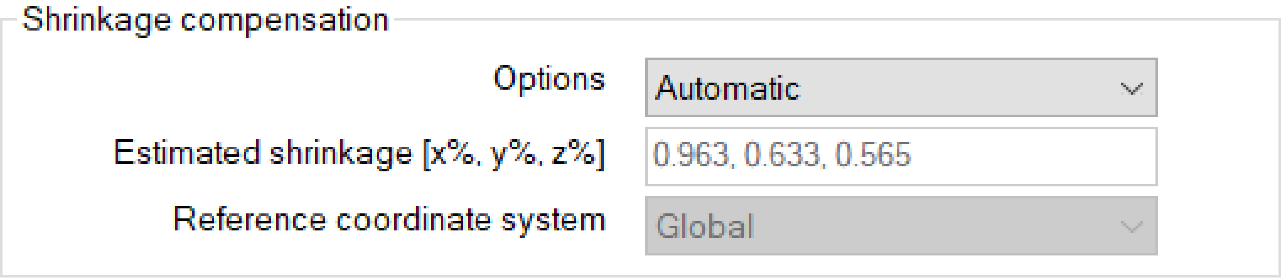


Part CAD vs Tool CAD



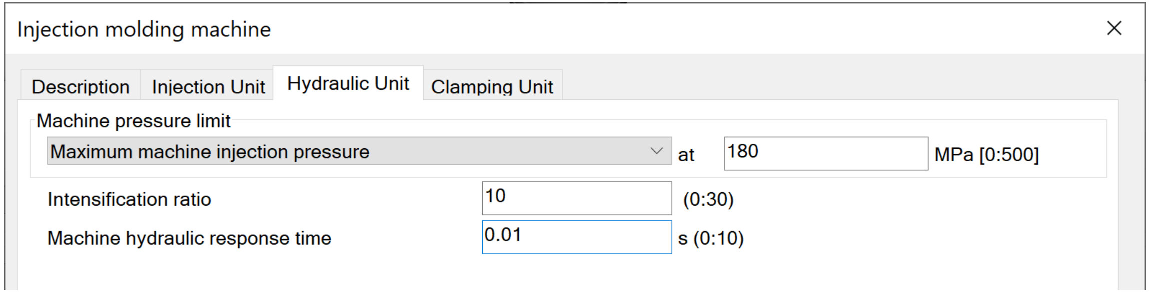
Shrink Compensation

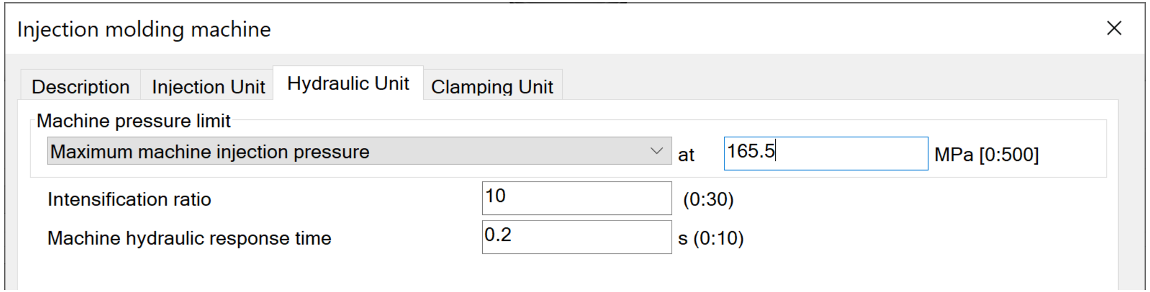
- Deflection, all effects – Plot Properties – Deflection Tab - Shrinkage Compensation
- Automatic, Isotropic, or Anisotropic available
- Runners and Cooling may influence these results
- Can be useful for determining our tooling shrink rates



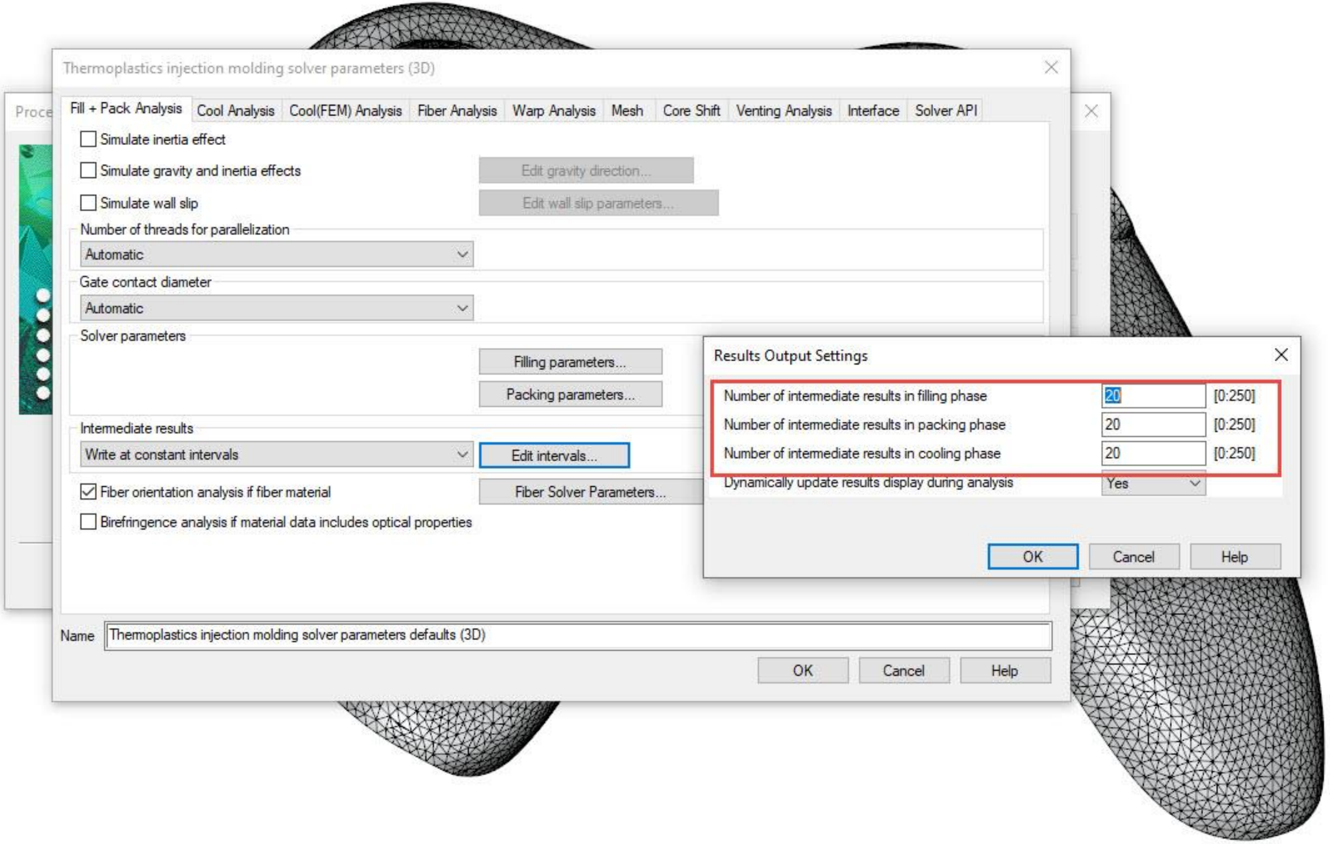
Injection Molding Machine

- Pick from public database
- Create your own Injection Molding Machine

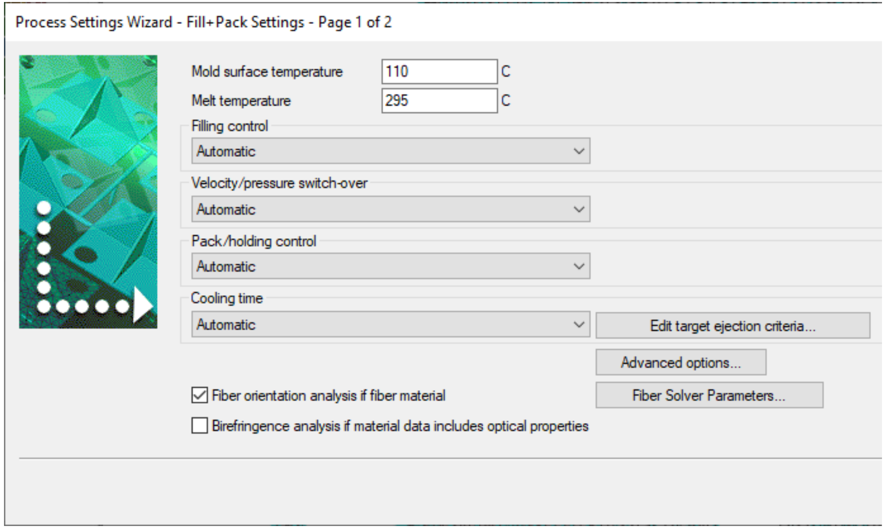


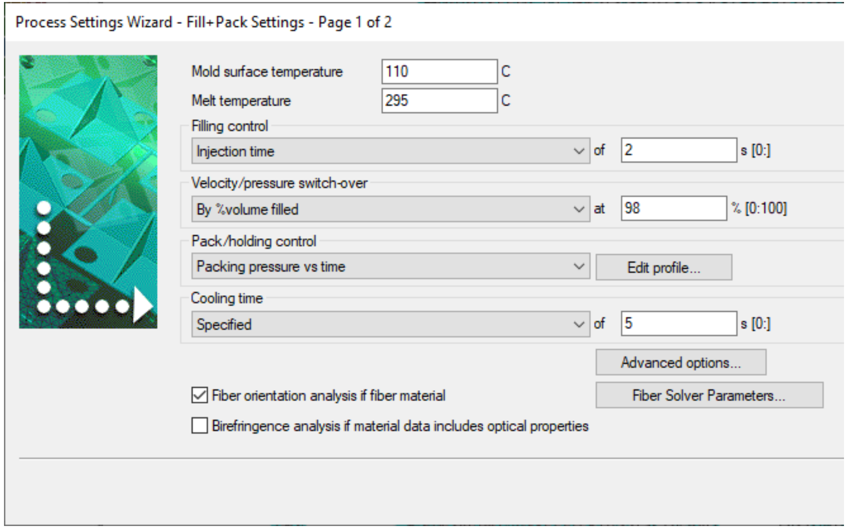


3D Intermediate Results



Process Settings

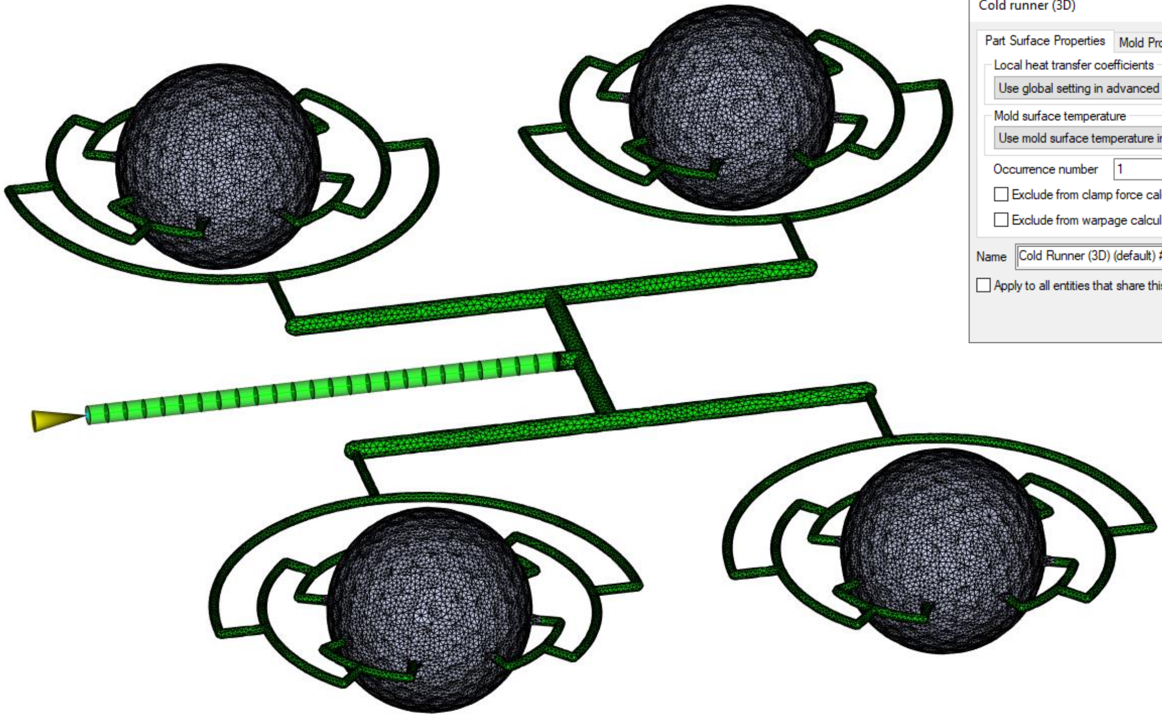


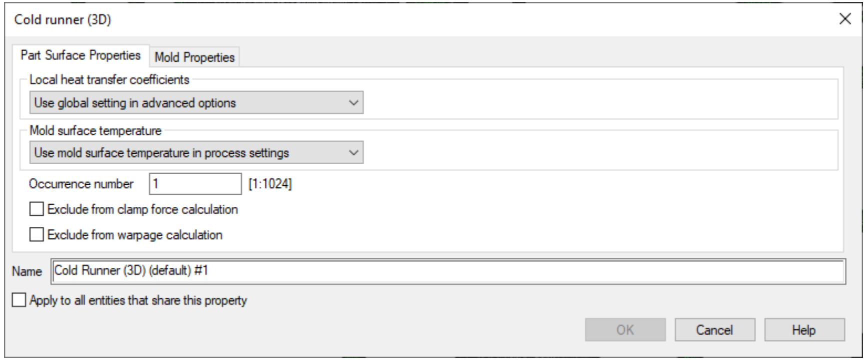


OK for Starting Point

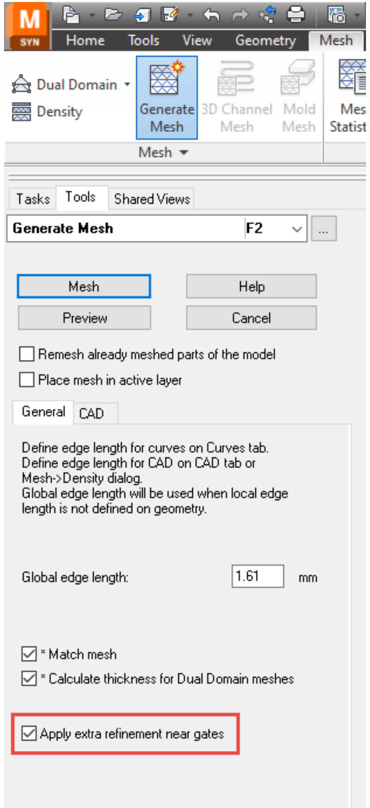
More Realistic Process

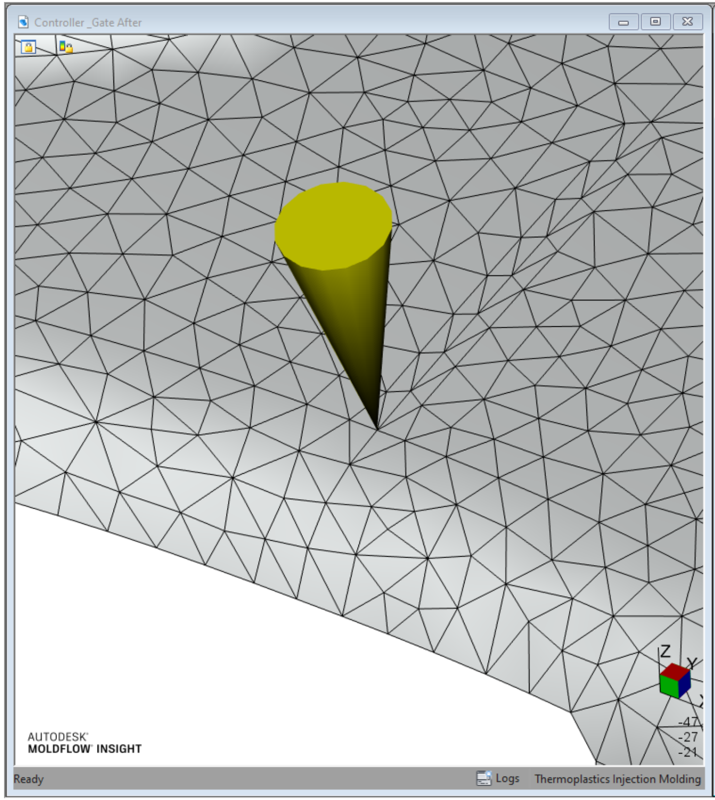
Runners & Runner Properties

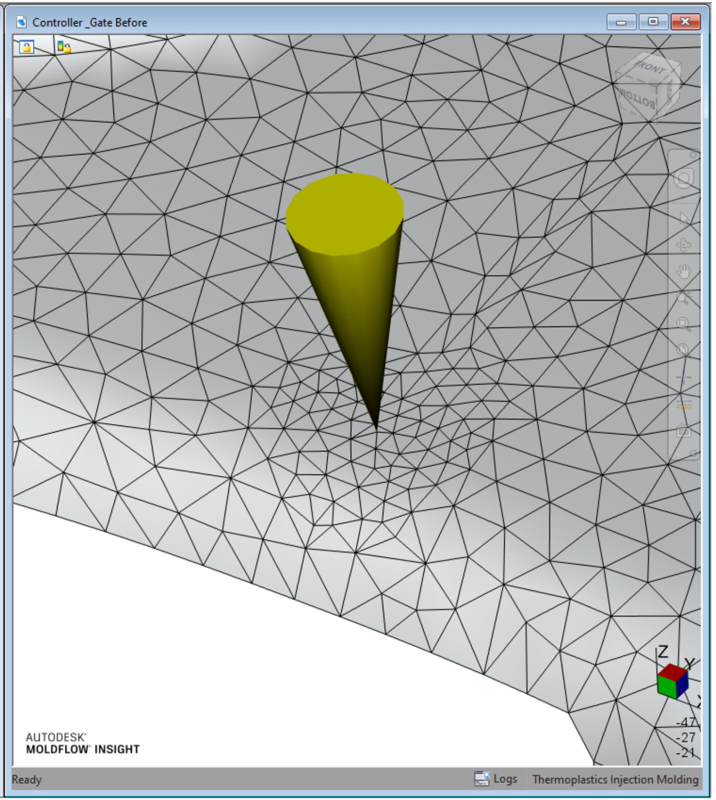




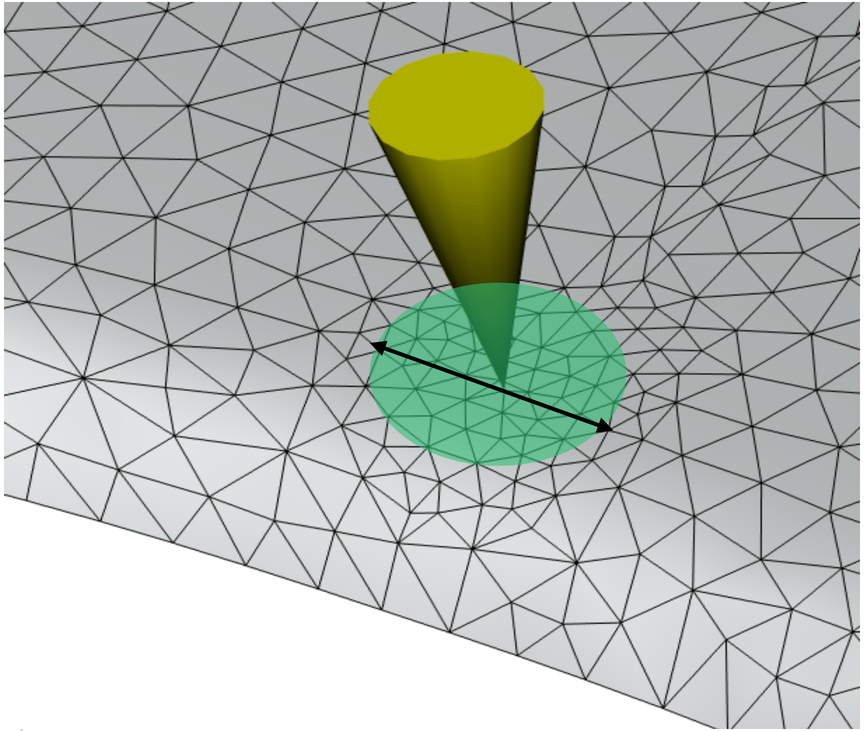
Meshing Gate Locations







Meshing Gate Locations

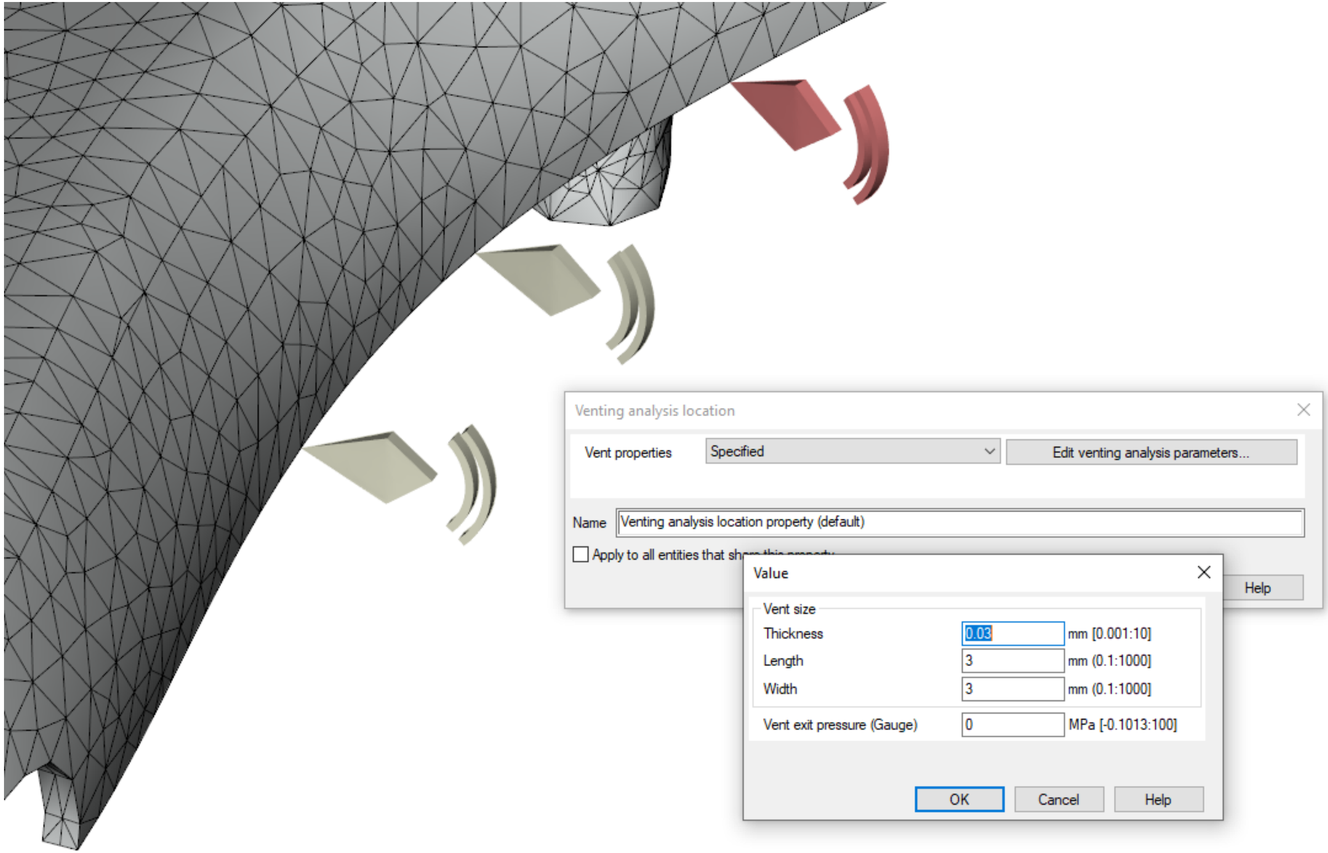


8 elements across gate
contact diameter

Gate contact diameter

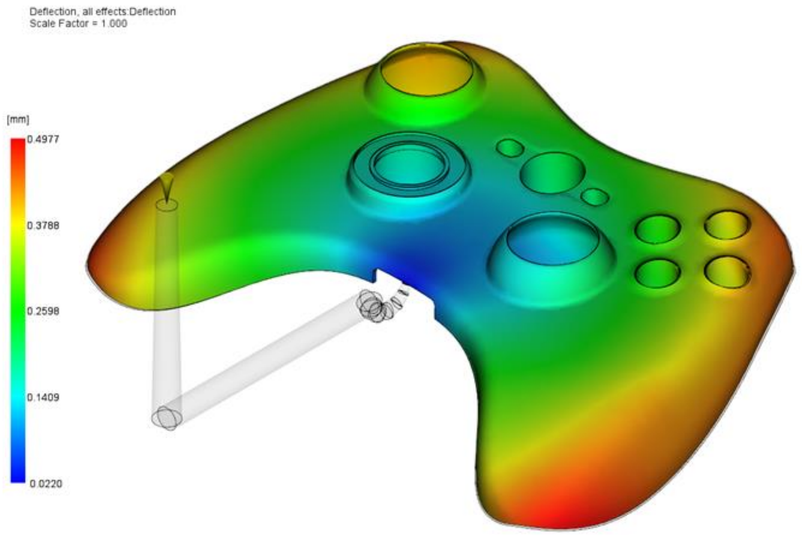
Specified | Gate diameter 2 mm

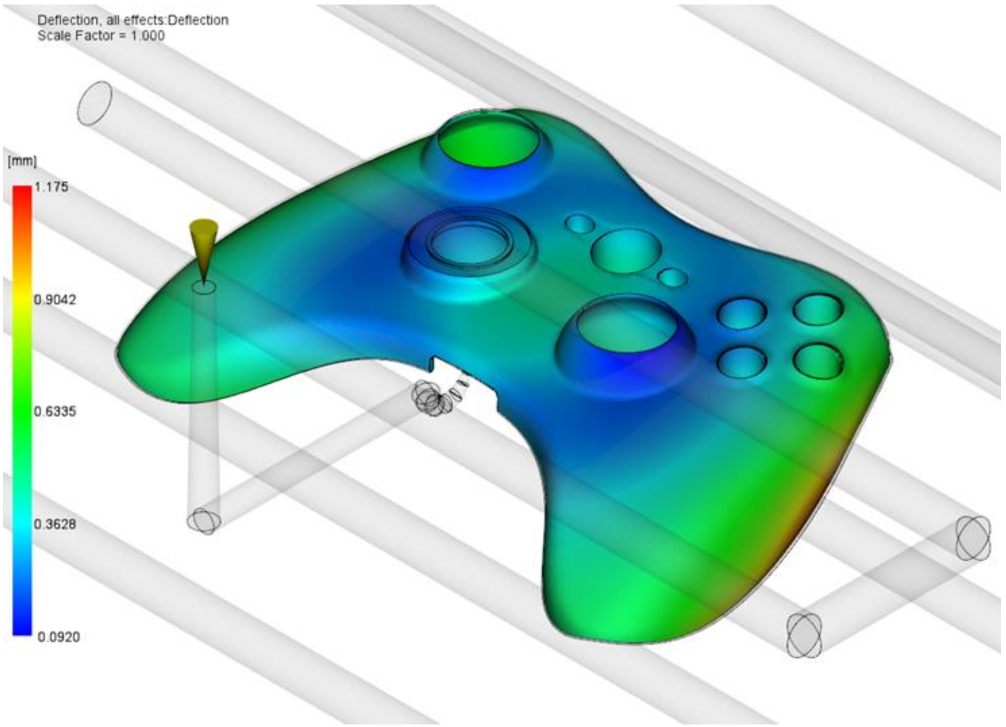
Venting



Venting analysis location
Vent properties
Specified
Edit venting analysis parameters...
Name
Venting analysis location property (default)
Apply to all entities that share this property
Help
Value
Vent size
Thickness
0.03
mm [0.001:10]
Length
3
mm (0.1:1000]
Width
3
mm (0.1:1000]
Vent exit pressure (Gauge)
0
MPa [-0.1013:100]
OK
Cancel
Help

Fill+Pack+Warp vs Cool+Fill+Pack+Warp

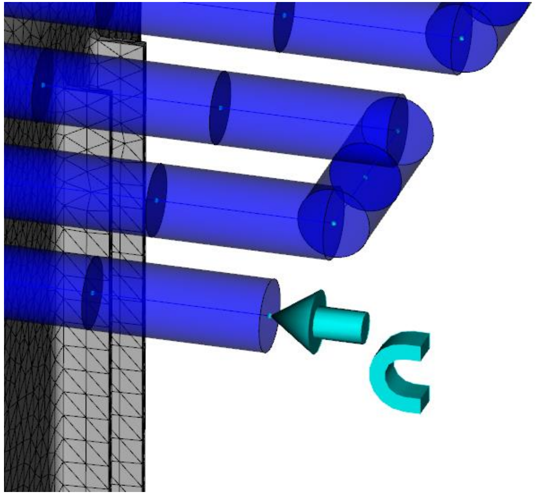




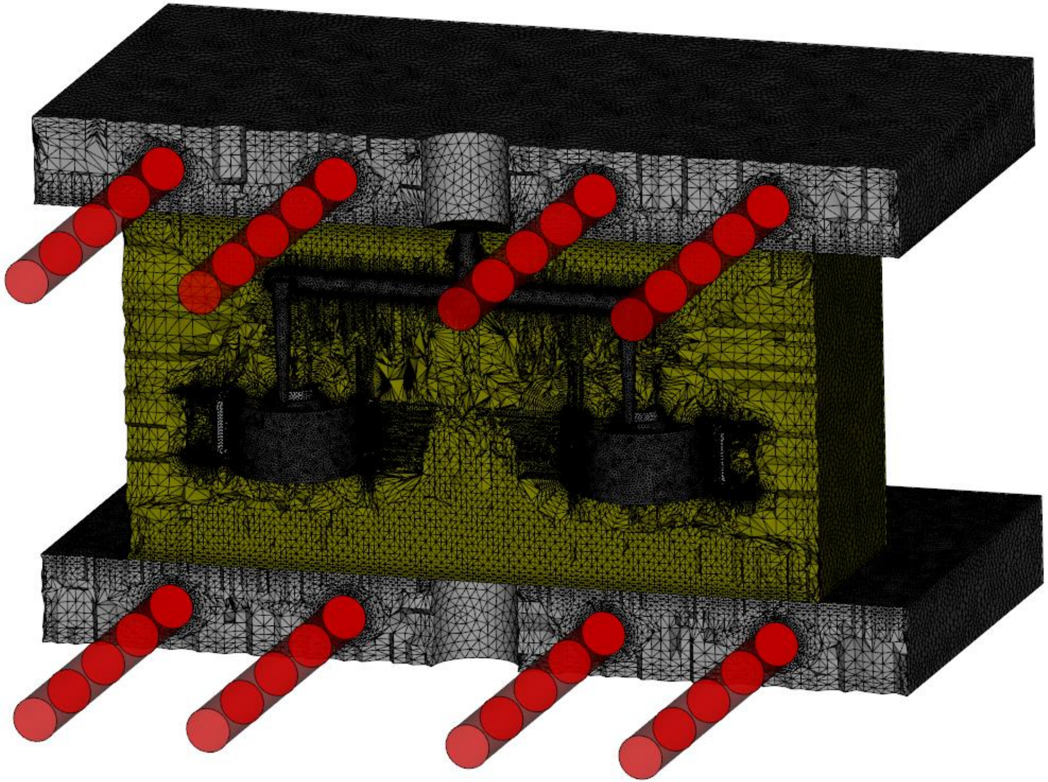
Cool vs Cool(FEM) Analyses

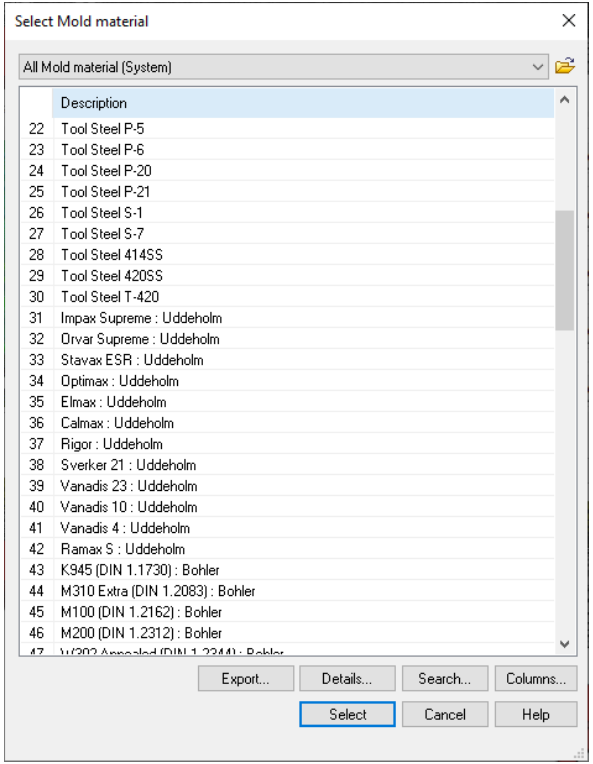
Coolant Inlet Temperatures

- Inlet temperature is determined primarily by the desired mold surface temperature
- Normally 10° to 30°C (~20º to ~55ºF) lower than mold surface temperature
- Optimum temperature will depend on
  - Distance between the cooling lines and the part
  - Thermal conductivity of the mold material

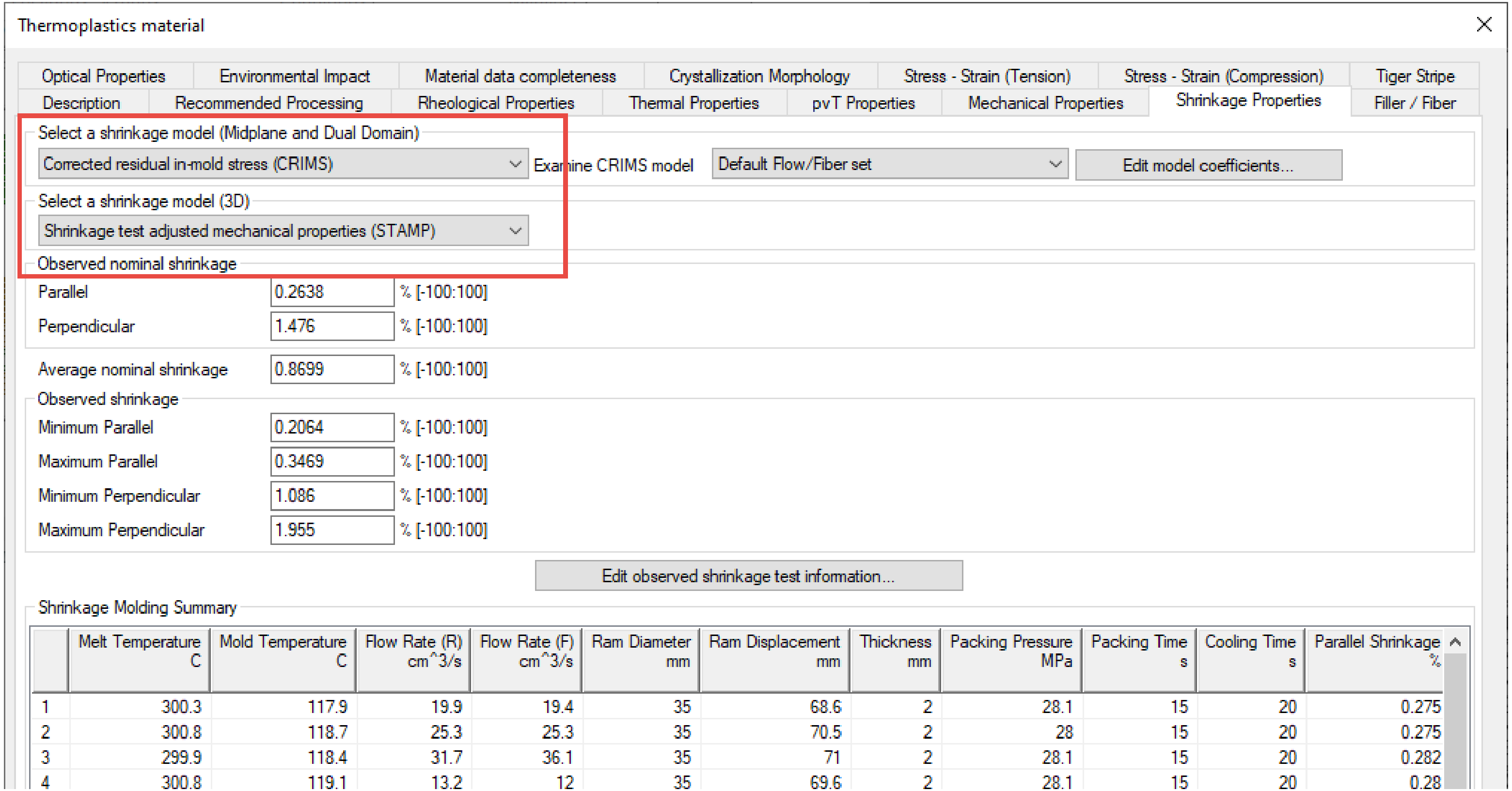


Tool Steel Database



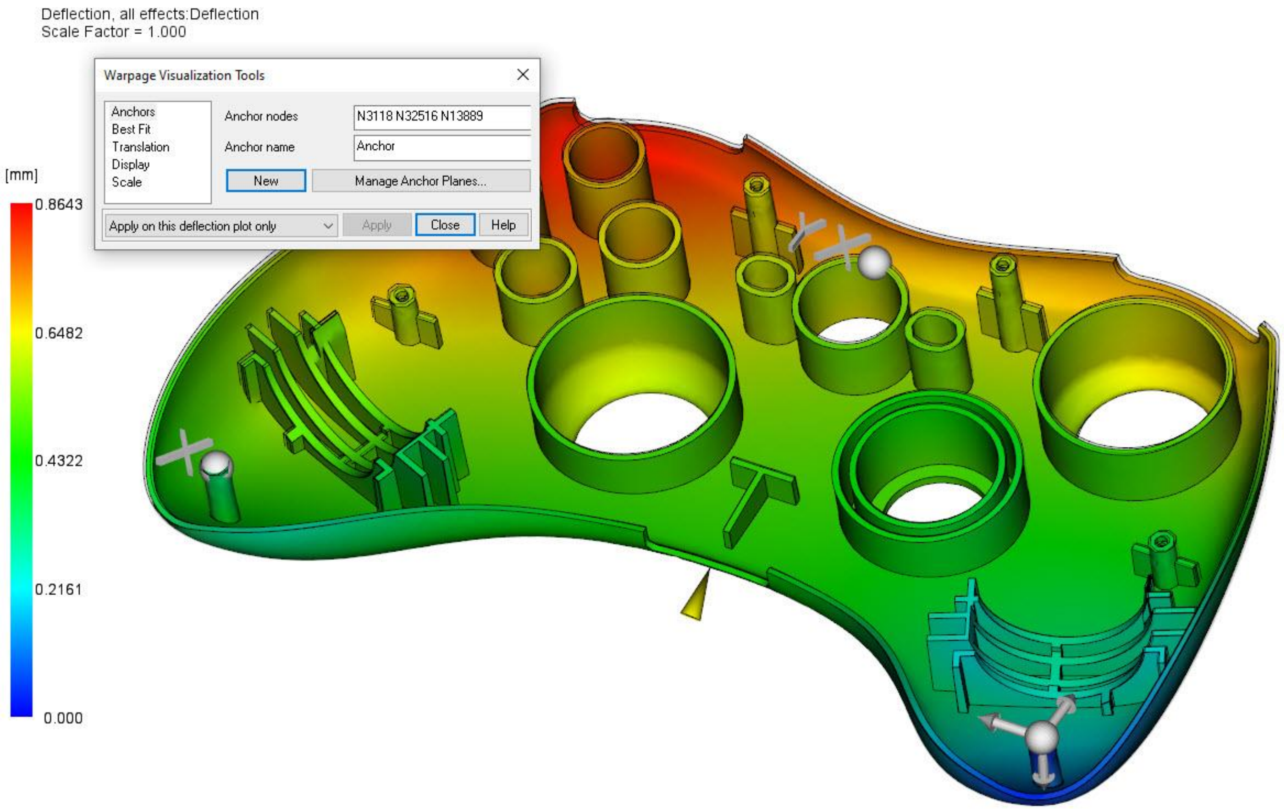


Warp Solver, Dual Domain and 3D

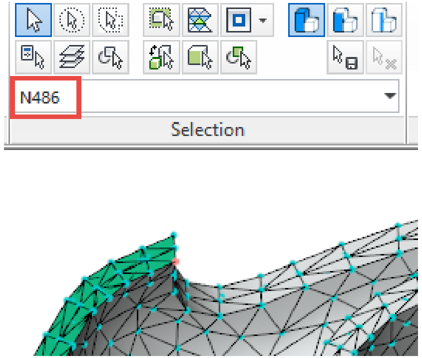


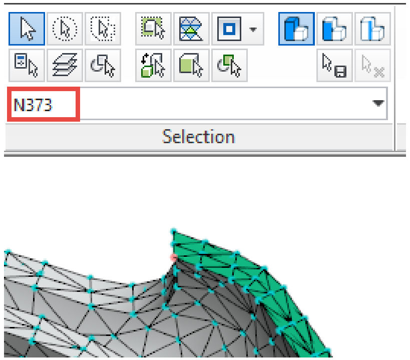
	Melt Temperature C	Mold Temperature C	Flow Rate (R) cm^3/s	Flow Rate (F) cm^3/s	Ram Diameter mm	Ram Displacement mm	Thickness mm	Packing Pressure MPa	Packing Time s	Cooling Time s	Parallel Shrinkage %
1	300.3	117.9	19.9	19.4	35	68.6	2	28.1	15	20	0.275
2	300.8	118.7	25.3	25.3	35	70.5	2	28	15	20	0.275
3	299.9	118.4	31.7	36.1	35	71	2	28.1	15	20	0.282
4	300.8	119.1	13.2	12	35	69.6	2	28.1	15	20	0.28

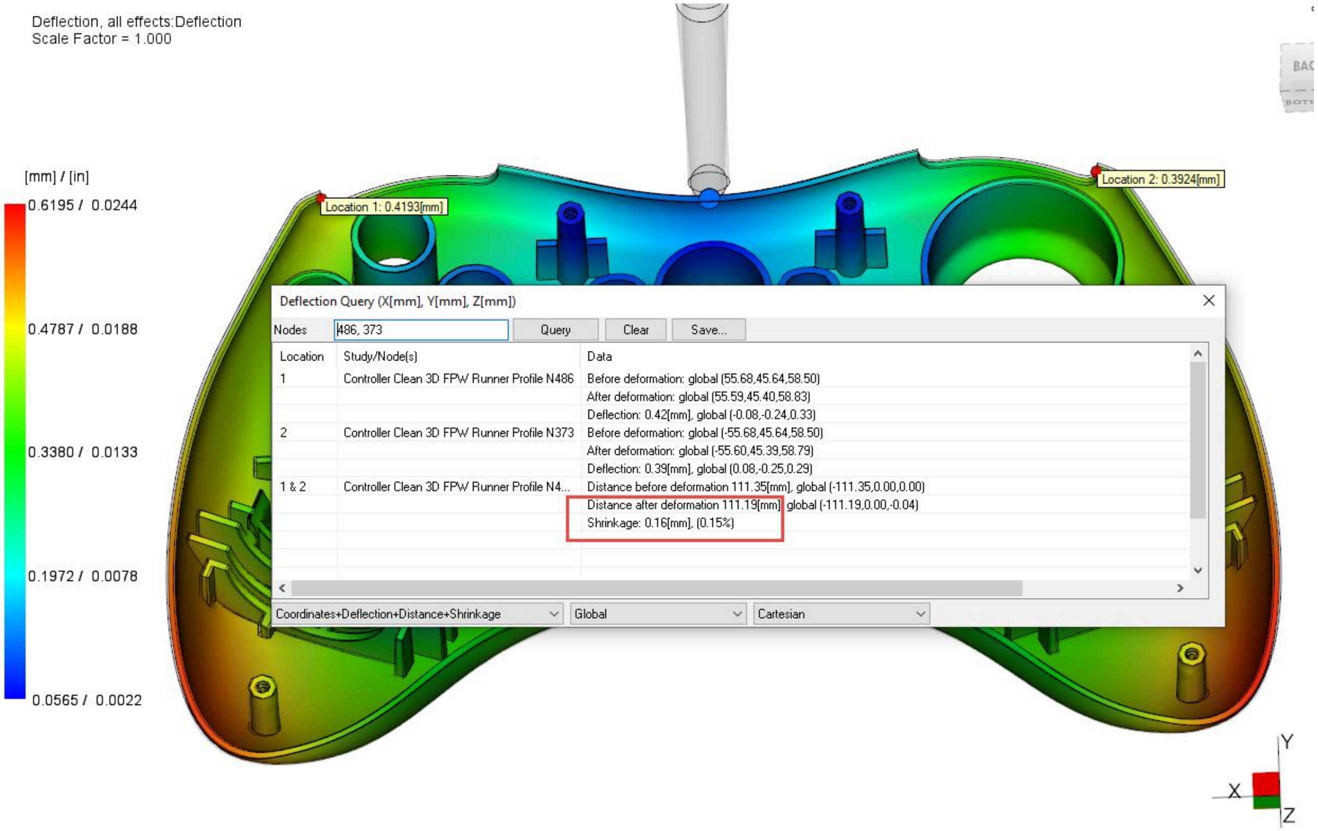
Anchor Point and Anchor Planes



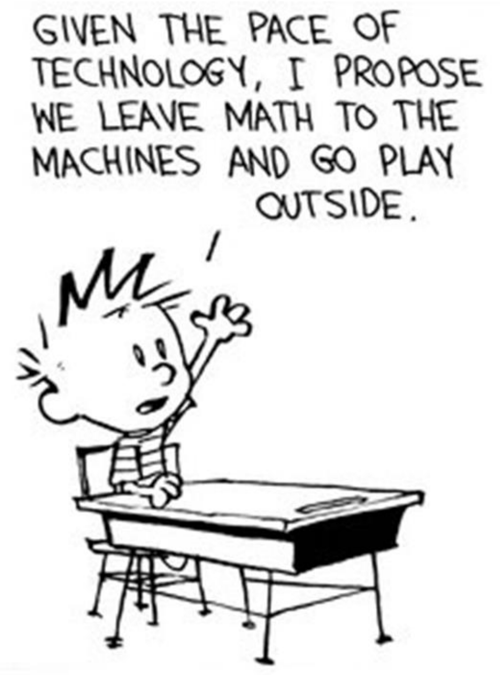
Measuring Linear Distances







Moldflow Solvers



$$K_i = \left(\frac{\phi_i}{\phi_r}\right)^3 - \left(\frac{1-\phi_r}{1-\phi_i}\right)^2 K_r$$

$$a_{ij} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \rightarrow \begin{bmatrix} \lambda_1 & 0 & 0 \\ 0 & \lambda_2 & 0 \\ 0 & 0 & \lambda_3 \end{bmatrix} ; \begin{bmatrix} e_1 & e_2 & e_3 \end{bmatrix}$$

$$P_{max} = \frac{F}{A} 100 \times 0.8$$

$$v_n = \frac{\partial p}{\partial n} = C$$

$$\alpha = \frac{\Delta L}{L_\circ \Delta T}$$

$$\Delta P = \frac{12 Q l \eta}{w t^3}$$

$$\varepsilon_i = \int_{T_r}^{T_0} \alpha_i(T) dT$$

$$\sigma_{ij} = \int_{-\infty}^{t} C_{ijkl}(\xi(t) - \xi(t')) \frac{\partial \varepsilon_{kl}}{\partial t'} dt' - \int_{-\infty}^{t} \beta_{ij}(\xi(t) - \xi(t')) dT(t')$$

$$T_c = \frac{t^2}{\alpha \pi^2} \ln \left| \frac{4}{\pi} \left(\frac{T_m - T_w}{T_e - T_w} \right) \right|$$

$$\tau = \frac{F}{A}$$

$$\{\sigma_g\} = -[D_g]\{\varepsilon_{g0}\} + \{\sigma_{g0}\}$$

$$[D_g] = [T_s^T][D_l][T_g]$$

$$[\varepsilon_{g0}] = -[T_s^{-1}][\varepsilon_{l0}]$$

$$\phi = 1 - \frac{1}{2b} \sum_{i=1}^{m} \frac{n_i \xi_i}{\rho_{fi}}$$

$$0 = \frac{\partial}{\partial z}\left(\eta \frac{\partial u}{\partial z}\right) - \frac{\partial p}{\partial x}$$

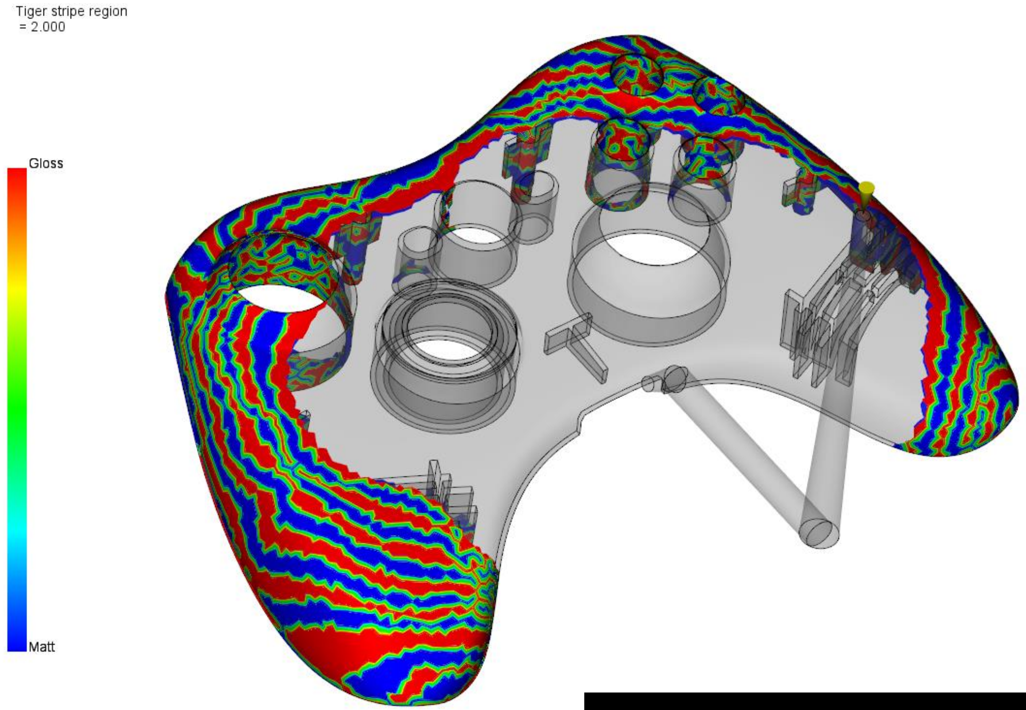
$$0 = \frac{\partial}{\partial z}\left(\eta \frac{\partial v}{\partial z}\right) - \frac{\partial p}{\partial y}$$

$$\Delta P = \frac{8 Q l \eta}{\pi r^4}$$

$$\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial v} + \frac{\partial(\rho w)}{\partial z} = 0$$

$$\rho C_p \left(\frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} + w \frac{\partial T}{\partial z} \right) = \frac{\partial}{\partial z}\left(k \frac{\partial T}{\partial z} \right) + \eta \Upsilon^2 + \frac{d\alpha}{dt} H$$

Project Scandium



Summary

- Please connect on LinkedIn
- Let me know what topics YOU want me to cover
- Small or seemingly insignificant items can lead to larger variations in simulation vs reality

AUTODESK

Make Anything