PTC® Live Global

CUST 219 - Designing Injection Molded Parts for Manufacturability Using PTC Creo Parametric

Doug Hippe
Director Continuous Improvement & Training
Extreme Tool & Engineering

June 9 2015

What is Design For Manufacturability and why consider it?

Design For Manufacturability (also known as **Design For Manufacturing** or **DFM**)

The general engineering art of designing products in such a way that they are easy to manufacture.*

There are (3) discrete areas to address: Tooling, Molding & Automation**

*From Wikipedia, the free encyclopedia
**Automation is an entirely unique subject so we won't be addressing that here…

Molding – What deters ease?

- Thin wall sections
- Hi-volume production rates (low cycle times)
- Hi-temperature materials
- Cosmetic requirements
- High level of part print detailing (Excess dimensions…)

Tooling – What deters ease?

- Contoured parting lines
- Complex actions
- Hi-temperature materials
- Cosmetic requirements
- High level of part print detailing (Excess dimensioning…)

Why is this Important?

PTC® Live Global

Part Design Considerations

PTC® Live Global

Gate location

- Does the detail around the gate accommodate the desired gate style?
- Will the gate style selected be cosmetically acceptable?
- Is the gate location on the thickest portion of the part filling to the thinnest? (wall section)
- Is there a need for multiple gate locations?
- Will the desired gate location allow for confident fill, balanced fill, promote best part strength, limit warp, limit weld lines, allow for end of fill venting? Sell our mold flow?
- Is there post mold operation to the gate that may require modification for easier machining?

Part Design Considerations

PTC® Live Global

Ejection

- Consider the speed and temperature of the part at mold open to determine how aggressive the ejection plan can to be
- Are there available locations for robust pin size for ejection?
- Are the ejector locations able to push the part off from the deepest features so as not to pull deeper detail using pins at shallower higher part elevation which can cause pin push?
- Is there sufficient area below or near the gate location to locate a pin for efficient de-gating?
- Is there the ability to generate pin bosses to keep the ejector pins on a flat surface?
- Are there available pin locations for post gate and end of fill sensors?
- How will the part be removed from the mold: Fall into a bin, robotic part removal, operator removal and are there appropriate features or design consideration for these methods?

Part Design Considerations

PTC® Live Global

Parting lines

- Do parting lines promote accurate machining methods? See Job # 1803 as example of overly complex P/L
- Do parting line steps have proper draft for shut-off angles built in?
  - Minimum 3° ROT: Shallow angles promote premature parting line wear
- Is there draft in both directions of pull from the parting line?
- Is there robust steel conditions on adjacent parting lines?
- Are there robust steel conditions between shut offs (transitions)?
- Is there Wiping shutoff/windows/doghouses/tabs/snap features that need to be modified for a better steel condition?

Part Design Considerations

PTC® Live Global

Draft

- Is there proper draft for any texture requirements?
  - ROT: 1° for each .001 of depth of texture
- Is there any issue with the texture/polish requirements that may limit tooling effectiveness?
  - Higher levels of polish on TPE's cause sticking
- Is there proper steps taken to insure there is no or very reduced sink on outside cosmetic surfaces?
  - Reference: Ribs and bosses to be 60-70% of nominal wall they attach to
- Is there any very heavy or very thin wall section that may not fill with the selected resin melt flow index?
  - Mention: over all flow length consideration
- Are wall thicknesses consistent or at a minimum be able to gate into and fill thick to thin?
- Are there features that require venting that are easily accessible to add venting in the tooling?
  - How much outgas is produced by the material you have selected?

Are dimensions on the part print critical function or interface items?

PTC® Live Global

Allow the 3D part Model to drive features not ***critical*** to fit and function

Why spend the time to detail non-critical features???

It all starts with this…

PTC® Live Global

Mold maker gets the part model

35% glass-filled PA (nylon) 66
.0037" parallel flow shrinkage
.0104" cross shrinkage.

Cosmetic requirements define location of gating

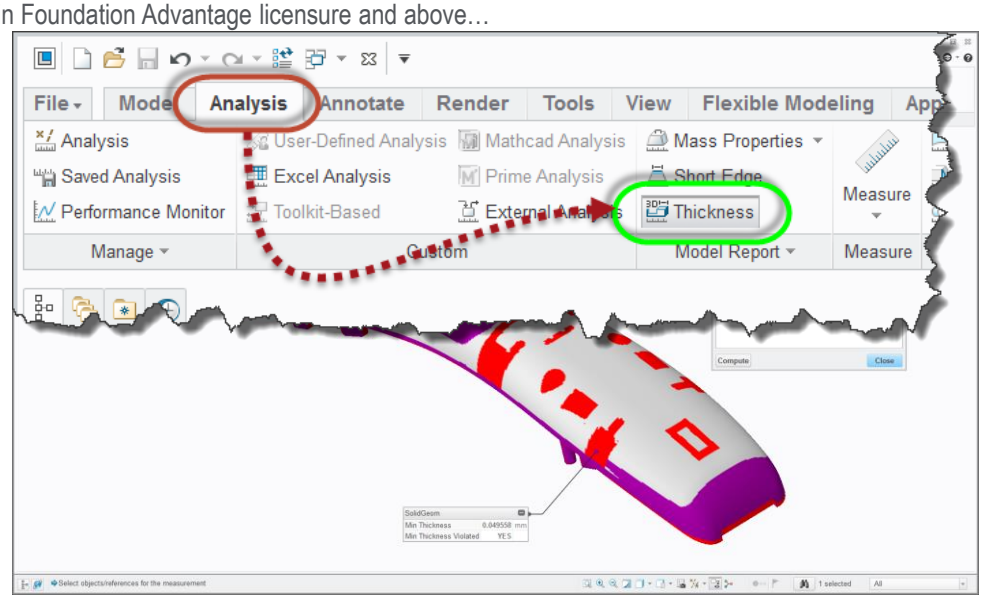
Warp/cool analysis reveals ~¼" of warp in the overall length of the part

3D Thickness analysis reveals inconsistent wall sections throughout part

3D Thickness Analysis

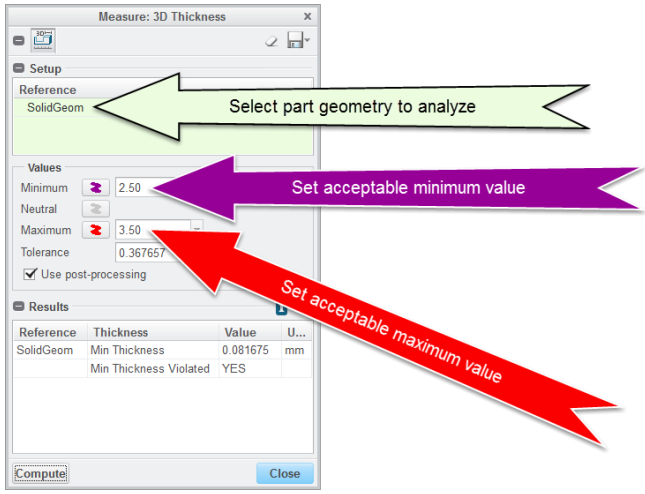
PTC® Live Global

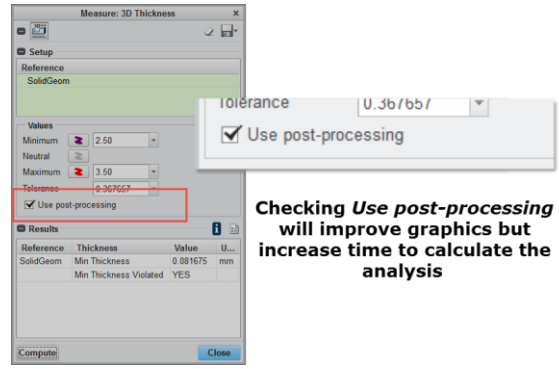
Available in Foundation Advantage licensure and above…



Setting up Your Thickness Analysis

PTC® Live Global

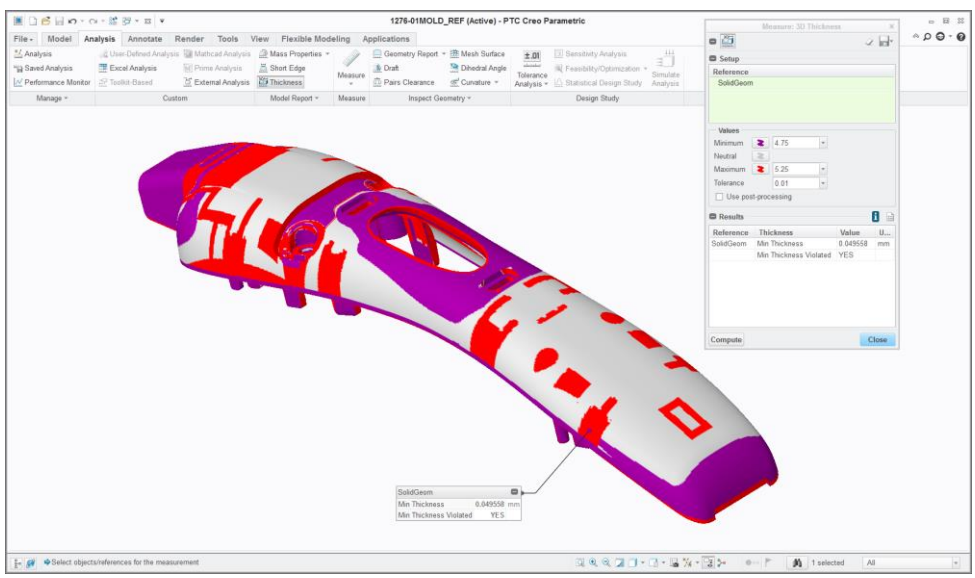




Checking *Use post-processing* will improve graphics but increase time to calculate the analysis

What to look for on your thickness analysis

PTC® Live Global



Placeholder for Plastic Flow Analysis

PTC® Live Global

Why understand plastic flow?

- Maintain common wall section throughout the part
- It is OK to leave corners sharp in your design and note: Corners shown sharp can have .XX radius unless otherwise specified

Placeholder for Part Draft Analysis

PTC® Live Global

Why analyze draft?

- Maintain common wall section throughout the part
- It is OK to leave corners sharp in your design and note: Corners shown sharp can have .XX radius unless otherwise specified

- Your feedback is valuable
- Don’t miss out on the chance to provide your feedback
- Gain a chance to win an instant prize!
- Complete your session evaluation now

PTC® Live Global

PTC® PRODUCT & SERVICE ADVANTAGE®