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LIVE

Building Robust Parametric Models:
Using Powerful Referencing Techniques to
Your Advantage

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PTC
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Agenda

- **Selection Review**
    - Simple Selection
    - Rule-based chains
    - Rule-based surface sets
    - Rule-based selection in Flexible Modeling

- **Intent References**
    - Part Mode
    - Sketcher

- **Advanced Intent Referencing**
    - Intent Reference Feature
    - Intent Reference Feature with Name and Search

- **Intent References in Action**

Mouse Controls – Basic Selection

Highlight Geometry		Over Geometry
Query to Next Item		Until Highlighted – You can always wait for tooltip
Select Highlighted Feature/Geometry		
Add/Remove Items from Selection	CTRL +	
Construct Chains or Surface Sets	SHIFT +	
Clear Selection		On Background

Remember, Rule-Based Chains or Surface Sets are Alive!

Advanced Selection – Rule-Based Chains

■ **Tangent Chains**

1. Select an "anchor" edge
2. Hold down SHIFT
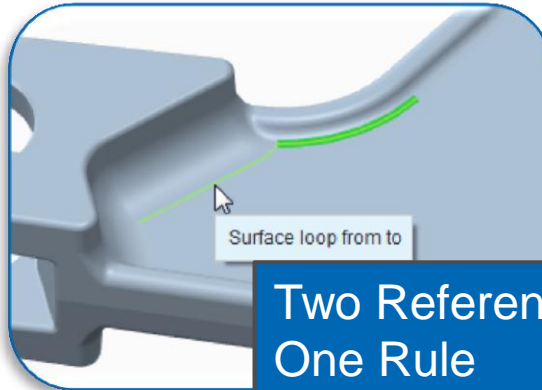3. Highlight tangent chain (may require query select)
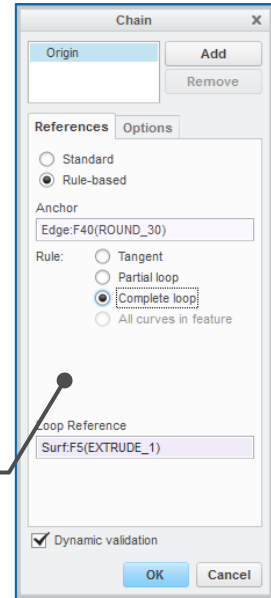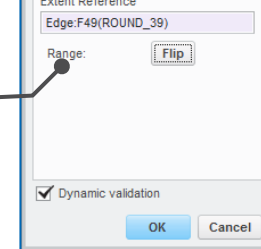4. Select tangent chain
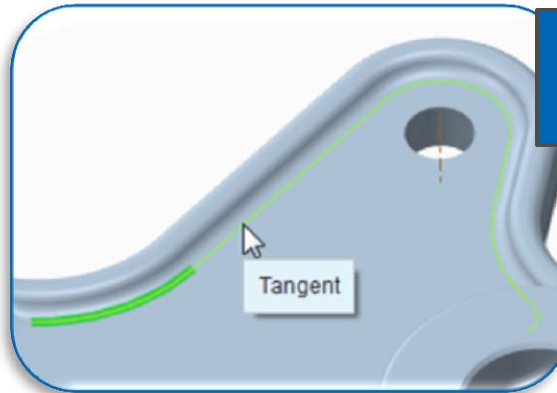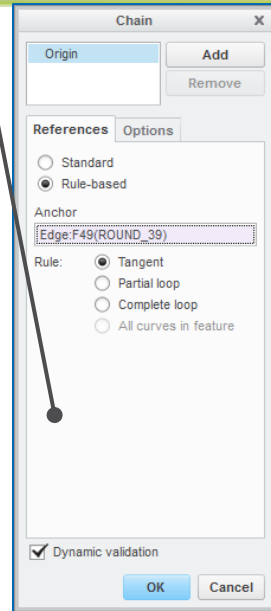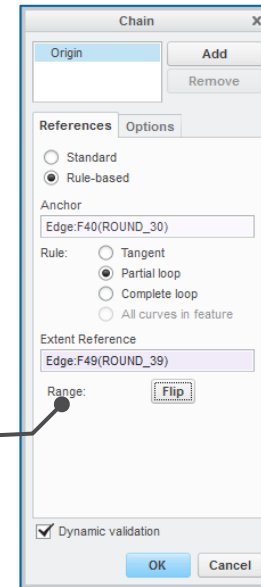
> **From-To Chain**

1. Select the from edge
2. Hold down SHIFT
3. Query to highlight the desired from-to chain
4. Select from-to chain

> **Surface Loop**
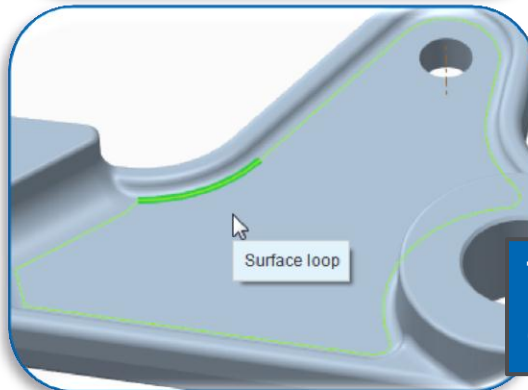
1. Select an edge
2. Hold down SHIFT
3. Highlight surface chain by hovering over surface (may require query select)
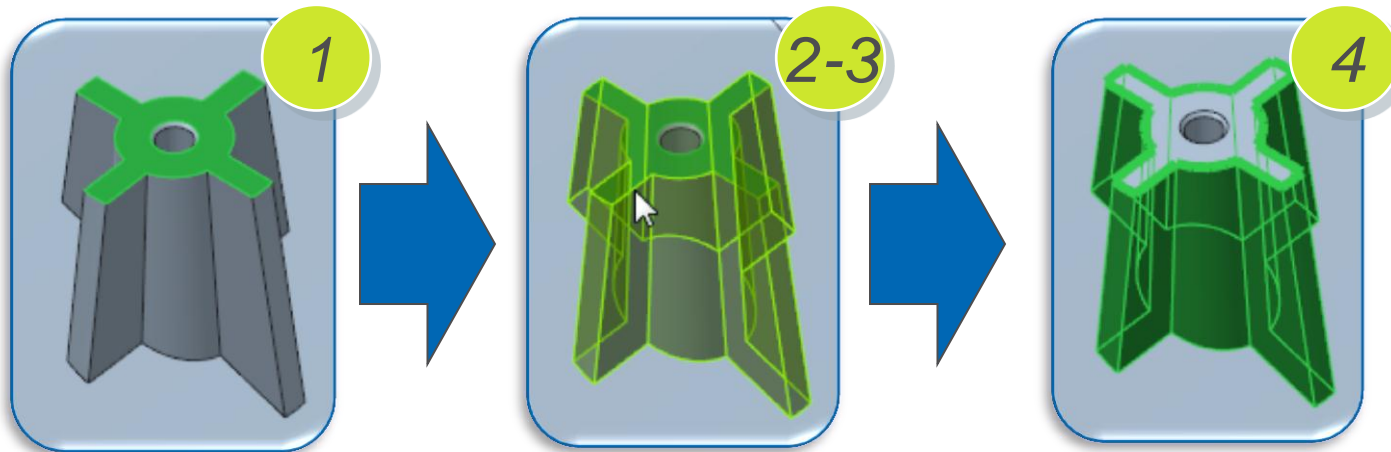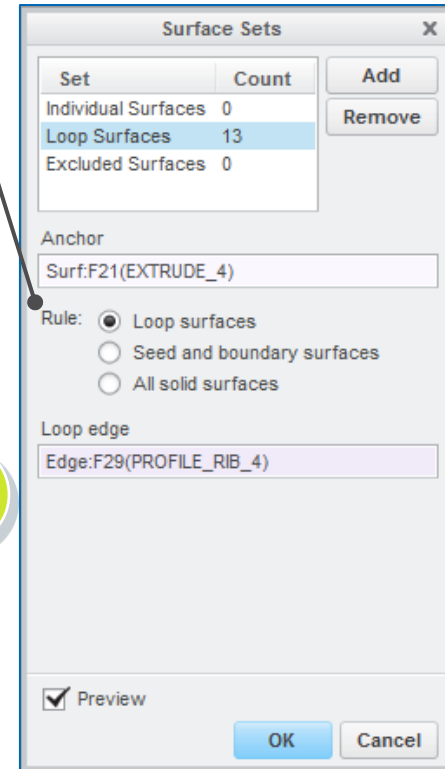4. Select surface loop

One Reference One Rule

Two References One Rule

Two References One Rule

4

Advanced Selection – Rule Based Surface Sets

- **Loop Surfaces – All surface patches adjacent to the continuous edge of one other surface patch**

1. Select a surface (the loop surface)

2. Hold down SHIFT

3. Hover over an edge of the surface to highlight loop surfaces

4. Select the edge – note the originally selected surface is deselected

Two References
One Rule

Surface Sets		
Set	Count	Add
Individual Surfaces	0	Remove
Loop Surfaces	13	
Excluded Surfaces	0	

Anchor
Surf:F21(EXTRUDE_4)

Rule: ● Loop surfaces
○ Seed and boundary surfaces
○ All solid surfaces

Loop edge
Edge:F29(PROFILE_RIB_4)

☑ Preview   OK   Cancel

1   *2-3*   *4*

The Power is in the Rule!

The weakness is in the references…

Advanced Selection – Rule Based Surface Sets

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- **Seed and Boundary Surfaces – All surfaces starting from a seed to a set of boundary surface patches**

  1. Select the seed surface patch

  2. Hold down SHIFT

  3. Select one or more surface patches to be used as boundaries

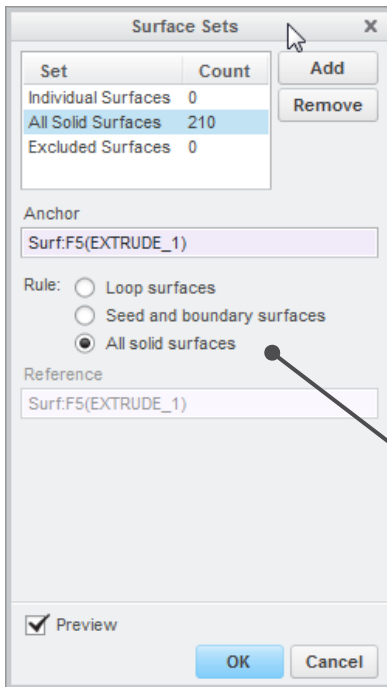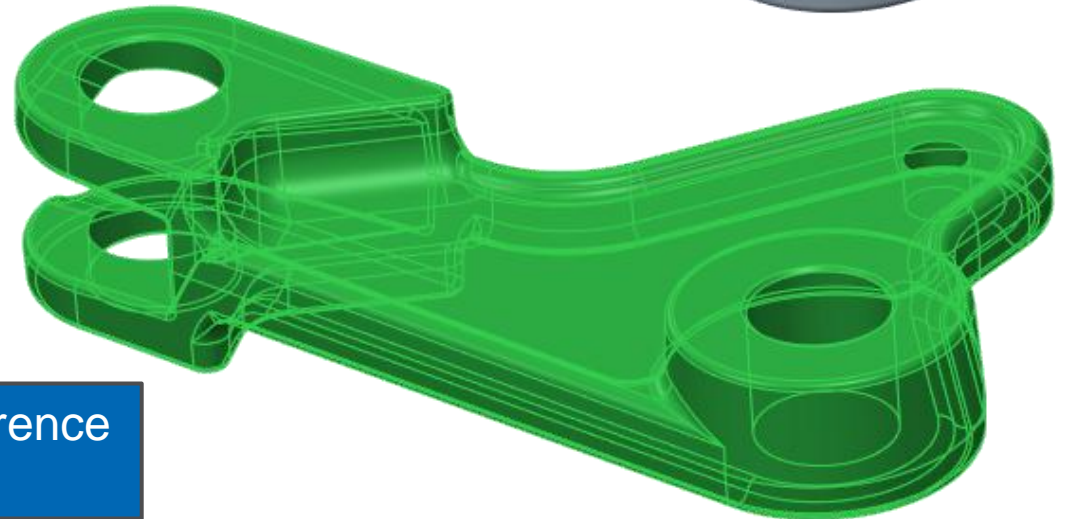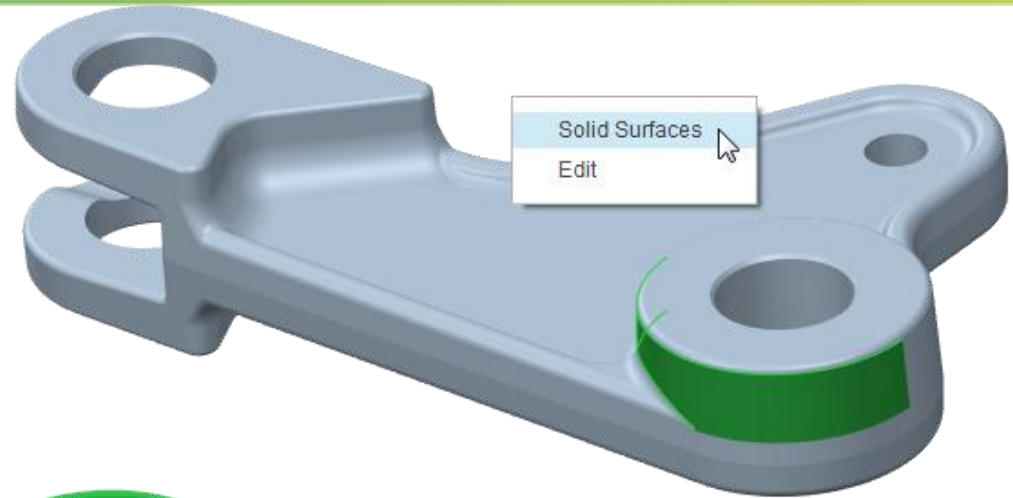 4. Final surface set is seen when you release SHIFT

Two References One Rule

1

2-3

4
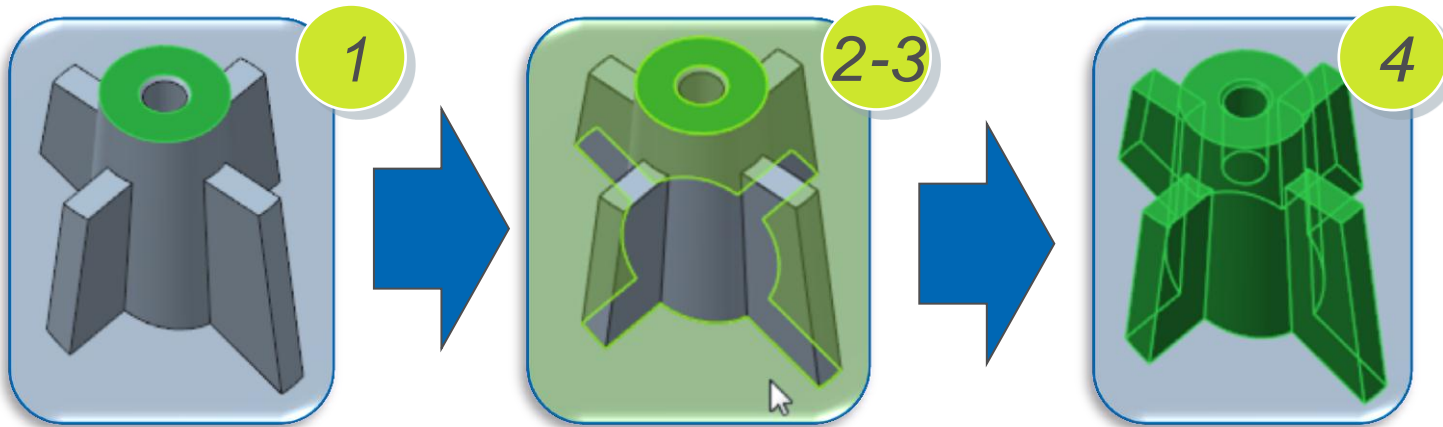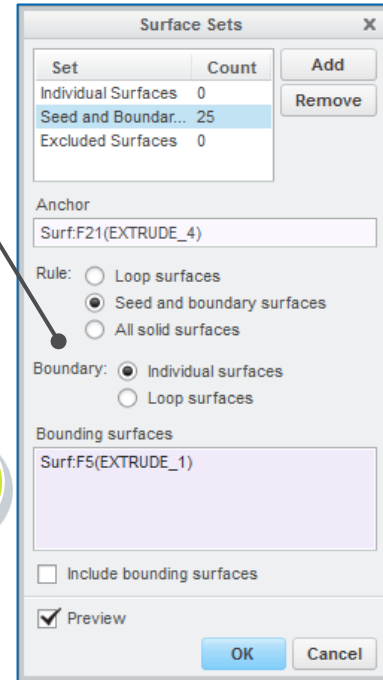
The Power is in the Rule!

The weakness is in the references…

- **Solid Surfaces**
  1. Select any surface on solid geometry
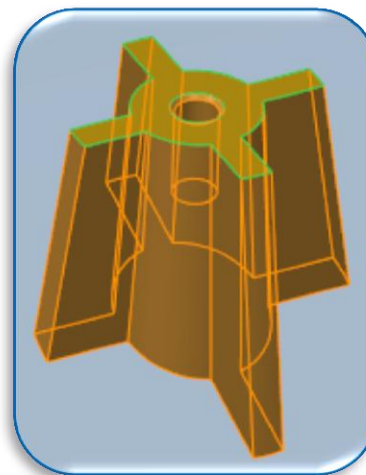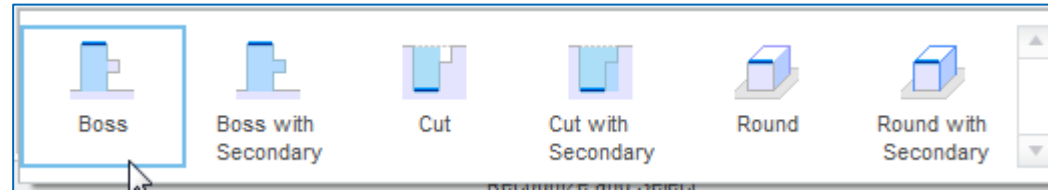 2. RMB→ Solid Surfaces

One Reference
One Rule

The Power is in the Rule!

The weakness is in the reference…
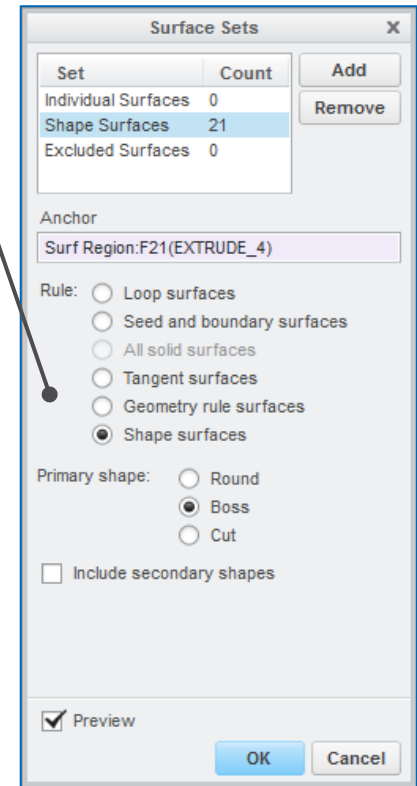
Flexible Modeling Extension

- **Shape Selection Rules**
  1. Select the Anchor surface
  2. Select the shape to recognize
     - Boss
     - Cut
     - Round
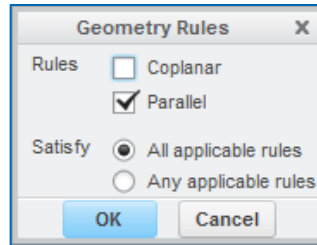   - With or without secondary surfaces

One Reference
One Rule

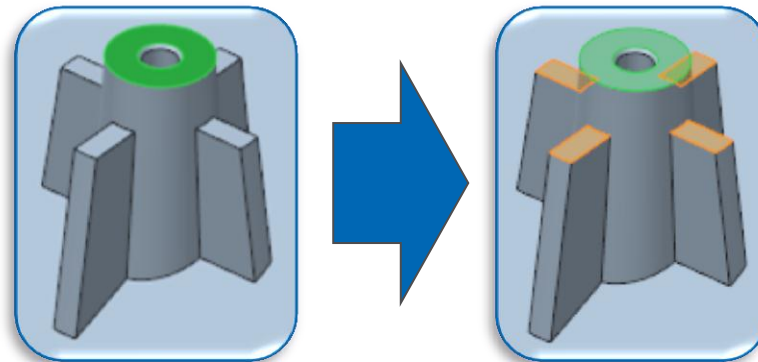The Power is in the Rule!

The weakness is in the reference…

Advanced Selection – Rule Based Flexible Modeling

Flexible Modeling Extension
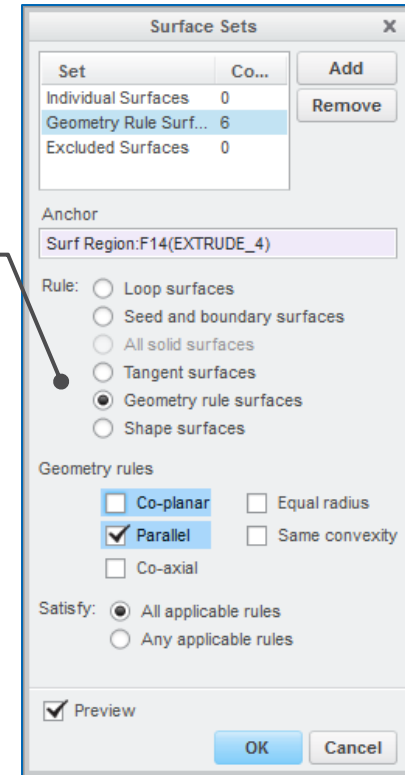
- ## Geometry Rules
    1. Select an Anchor surface on analytic geometry
        - cylinders, planes, cones, spheres, tori
    2. Select Geometry Rules
    3. Apply any or all rules
        - Coplanar
        - Parallel
        - Coaxial
        - Equal radius
        - Same convexity
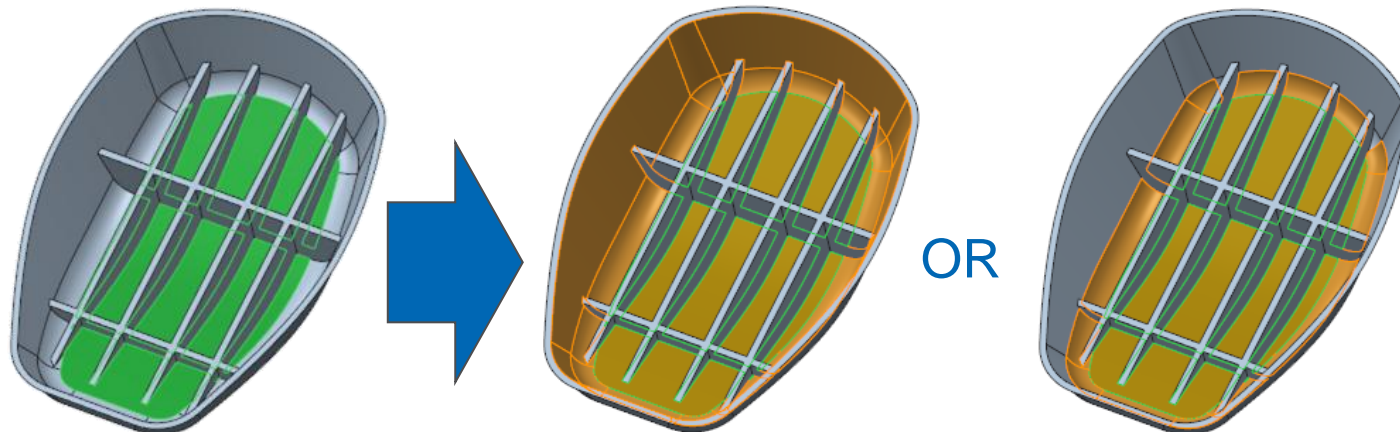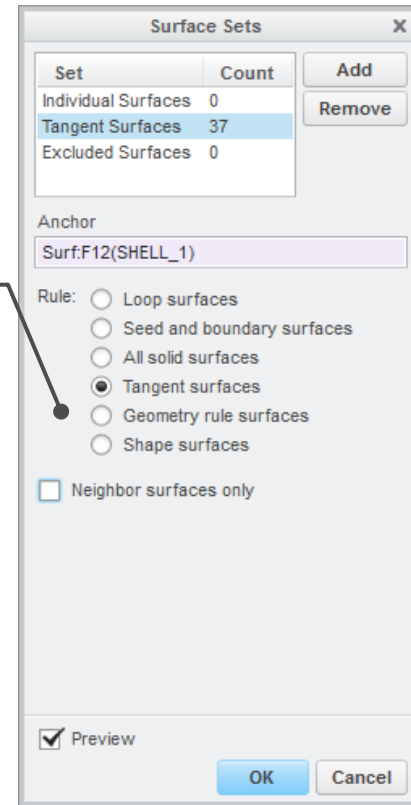
One Reference One Rule

The Power is in the Rule!

The weakness is in the reference…

Flexible Modeling Extension

- **Tangent Surfaces Rule**
  1. Select the Anchor surface
  2. RMB > Tangent Surfaces
     - Quickly select tangent chains of surfaces
     - All tangent surfaces OR first neighbor

**One Reference
One Rule**

Surface Sets		✕
Set	**Count**	**Add**
Individual Surfaces	0	**Remove**
Tangent Surfaces	37	
Excluded Surfaces	0	

Anchor
Surf:F12(SHELL_1)

Rule:
- ◯ Loop surfaces
- ◯ Seed and boundary surfaces
- ◯ All solid surfaces
- ⬤ Tangent surfaces
- ◯ Geometry rule surfaces
- ◯ Shape surfaces

☐ Neighbor surfaces only

☑ Preview

OK   Cancel

OR

The Power is in the Rule!

The weakness is in the reference…

Let's See Rule-Based References In Action!

# Intent References Defined

- **Intent References, a.k.a Intent Objects**
  - Families of associated objects:
    - Points
    - Curves
    - Edges
    - Surfaces
  - Logically define the boundaries of geometry created or modified by a feature.
  - Automatically created based upon model geometry
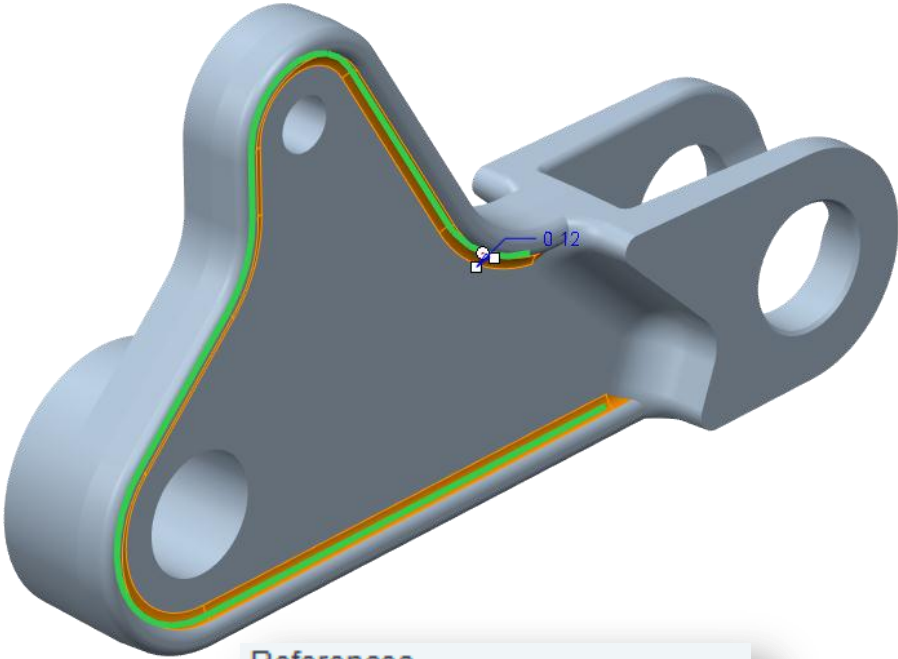 - Always regenerated

- **Intent Reference Features**
  - Allow you to combine any types of references, including intent references
  - Can be searched by other Intent Reference Features

Intent Chains at Geometry Intersections of Features
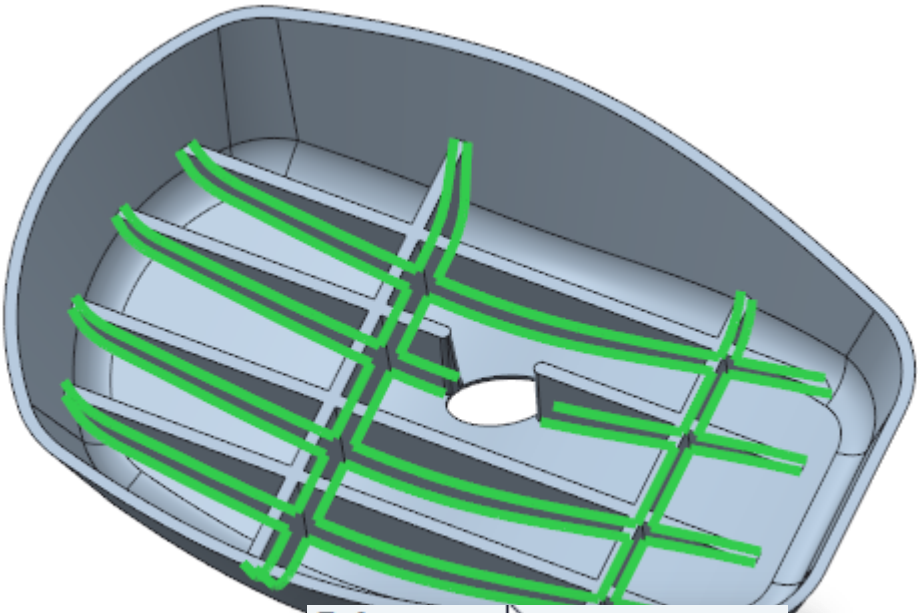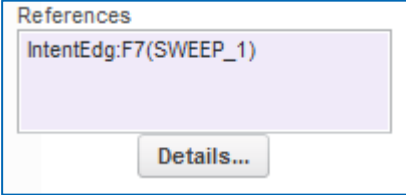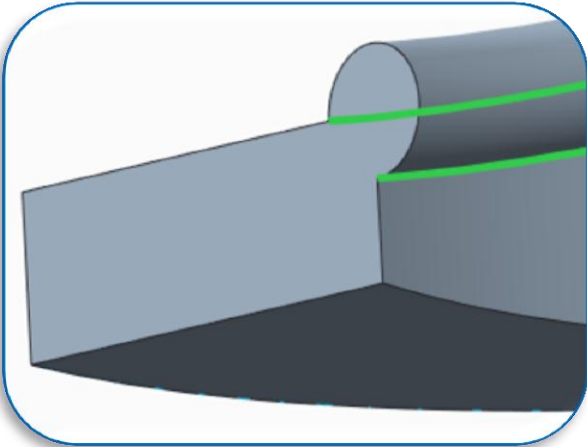
References
IntentEdg:F29(TRAJECTORY_RII
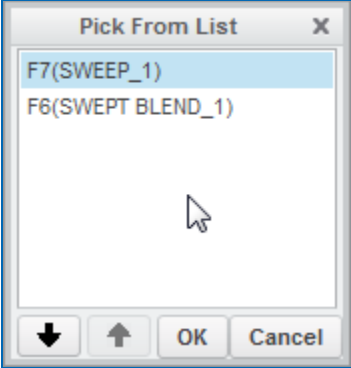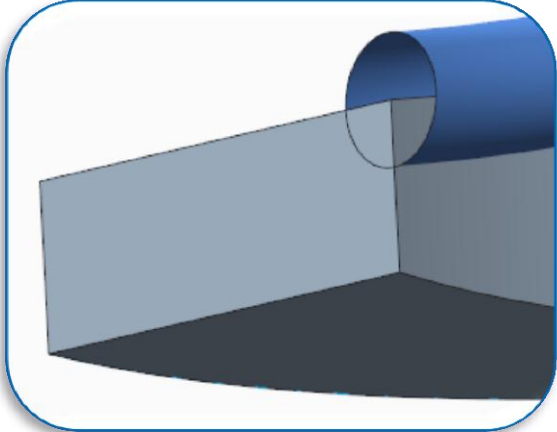Details...

References
IntentEdg:F12(PROTRUSION)
Details...

The Reference is a Rule…
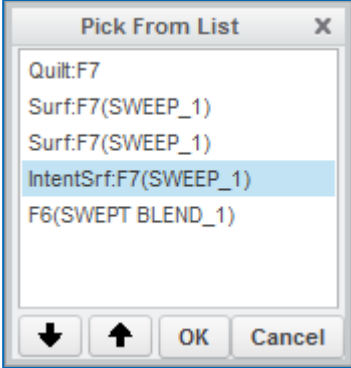## No "Anchor" References to Fail!

Between Solid and Solid is the Standard

Surface & Solid Why doesn't this work?

Surface & Surface Why doesn't this work?

References
IntentEdg:F7(SWEEP_1)

Details...

Pick From List ✕
F7(SWEEP_1)
F6(SWEPT BLEND_1)

↓ ↑ OK Cancel

Pick From List ✕
Quilt:F7
Surf:F7(SWEEP_1)
Surf:F7(SWEEP_1)
IntentSrf:F7(SWEEP_1)
F6(SWEPT BLEND_1)

↓ ↑ OK Cancel

Simple Sketch-Based Features

Swept Blend

References
IntentEdg:F12(Swept Blend_1)
Details...

References
IntentEdg:F8(EXTRUDE_13)
IntentEdg:F7(EXTRUDE_12)
Details...
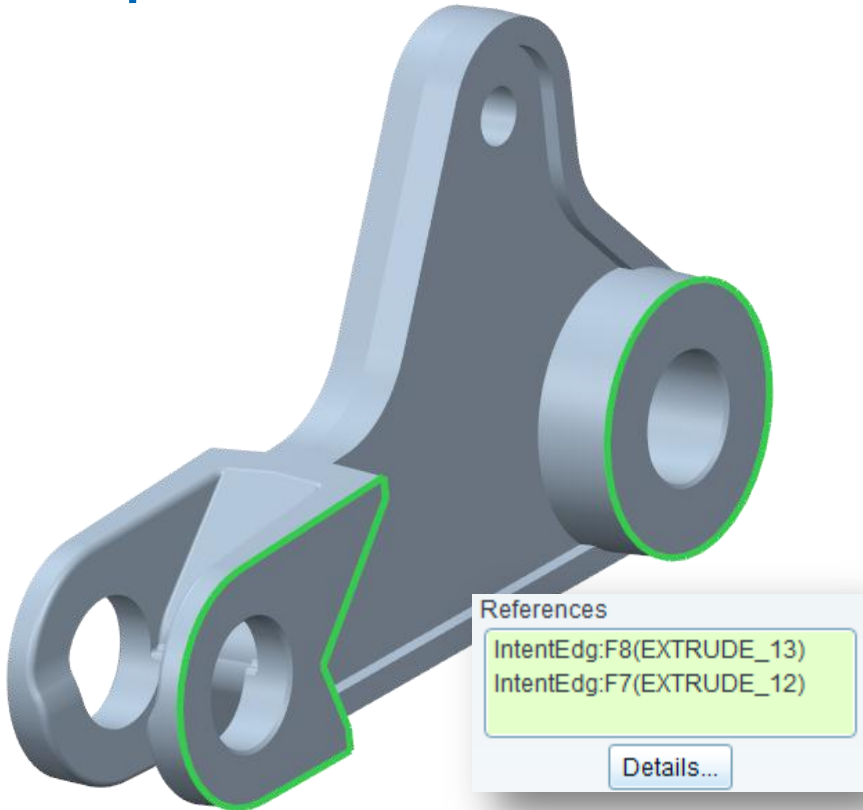
Sweep / Variable Section Sweep

References
IntentEdg:F12(VAR_SECT_SWEE
Details...
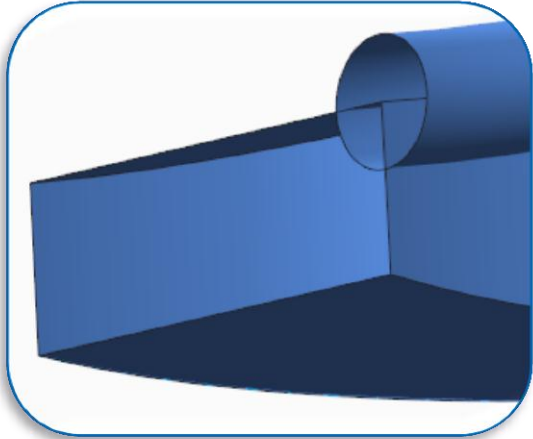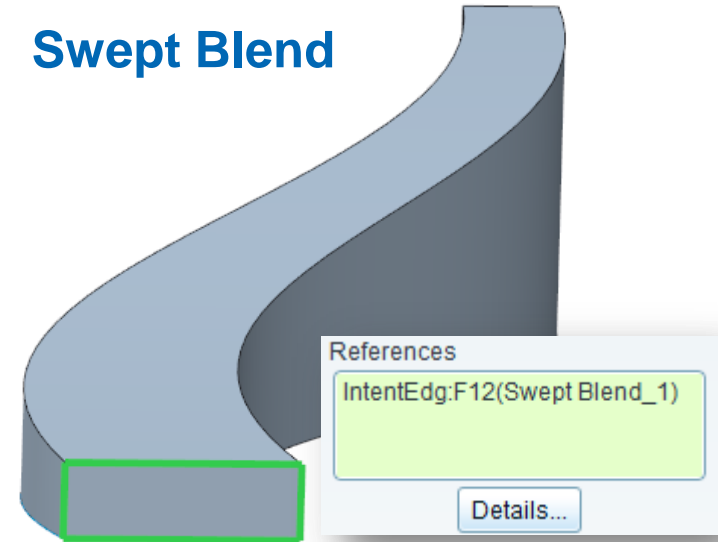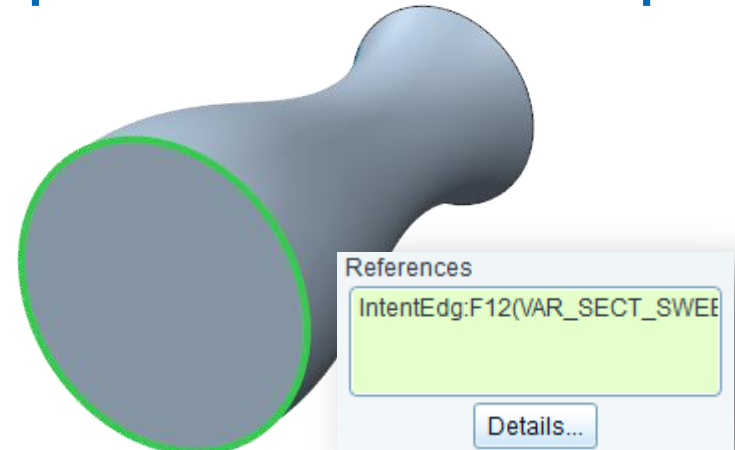
The Reference <u>is</u> a Rule…
No "Anchor" References to Fail!

Swept Blend

References
IntentEdg:F6(SWEPT BLEND_1)

Details...

Extrude

References
IntentEdg:F5(EXTRUDE_1)

Details...

1.25

Revolve

References
IntentEdg:F5(REVOLVE_1)

Details...
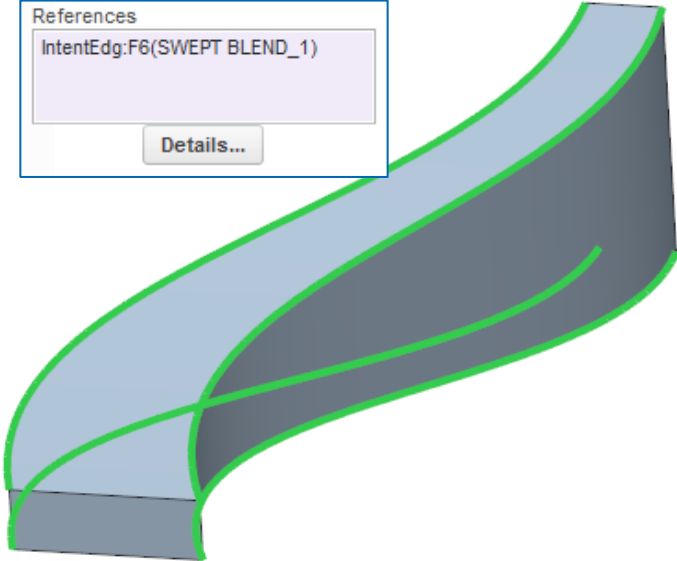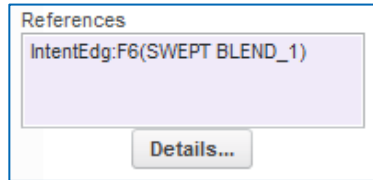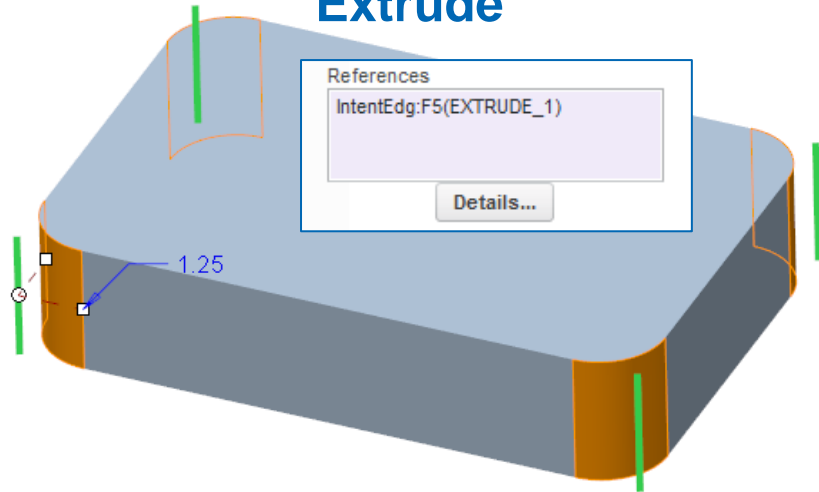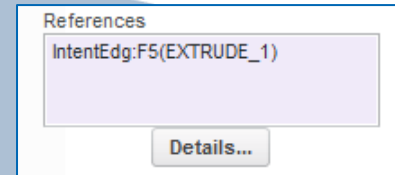
Also for:
- Sweeps (VSS & Standard)
- Blends (Parallel, Rotational, General)
- Rounds, Chamfers

The Reference <u>is</u> a Rule…
No "Anchor" References to Fail!
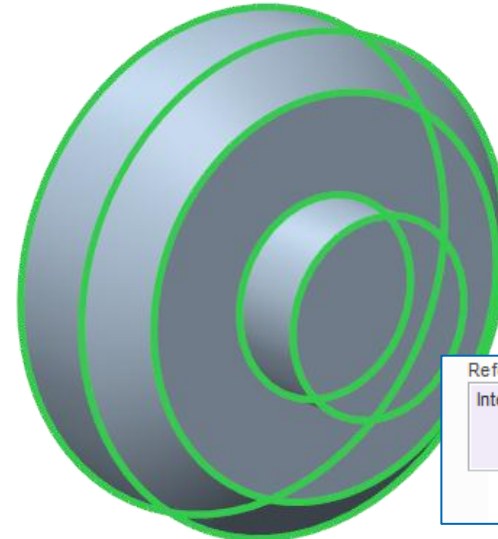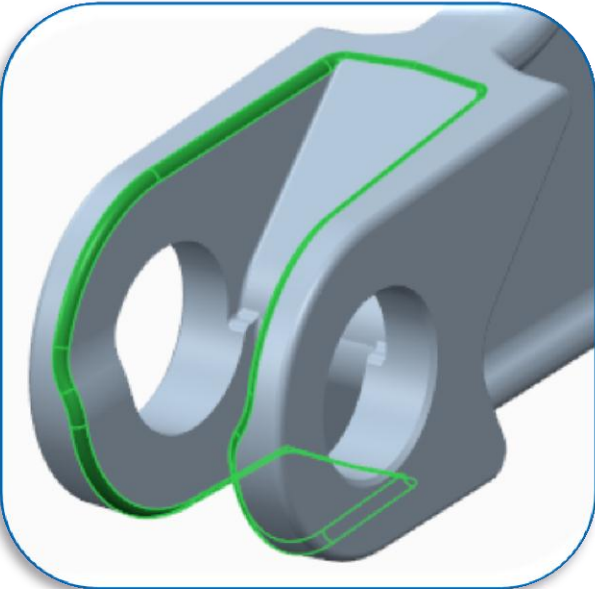
Intent References - Surfaces
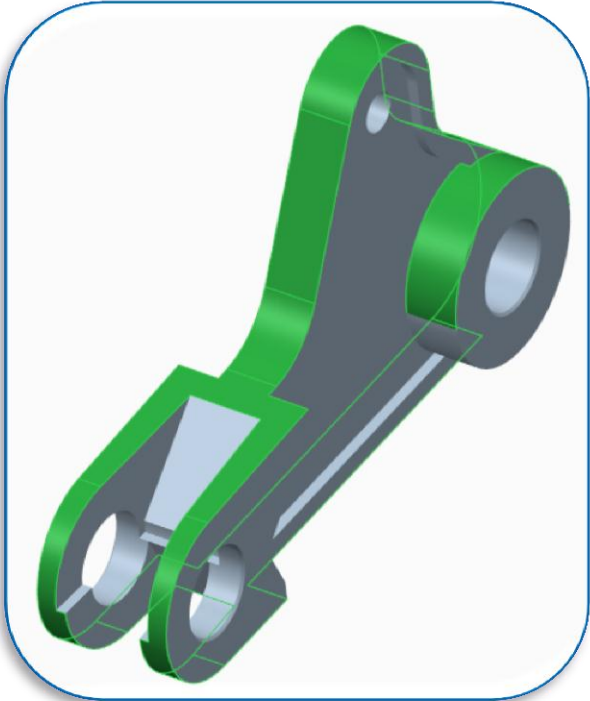
**All Surfaces of
Round/Chamfer**

**Start or End
Surface Profile**

**Around Feature
Profile Surfaces**

Anchor
IntentSrf:F32(ROUND_27)
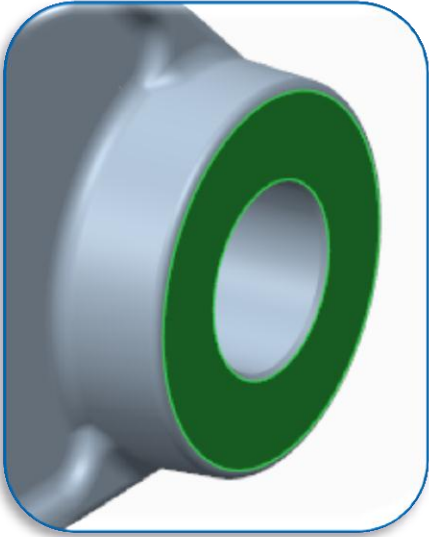
Anchor
IntentSrf:F7(EXTRUDE_12)

Anchor
IntentSrf:F5(EXTRUDE_1)

Sketcher Access to Intent References

Sketcher Can Reference Intent Chains
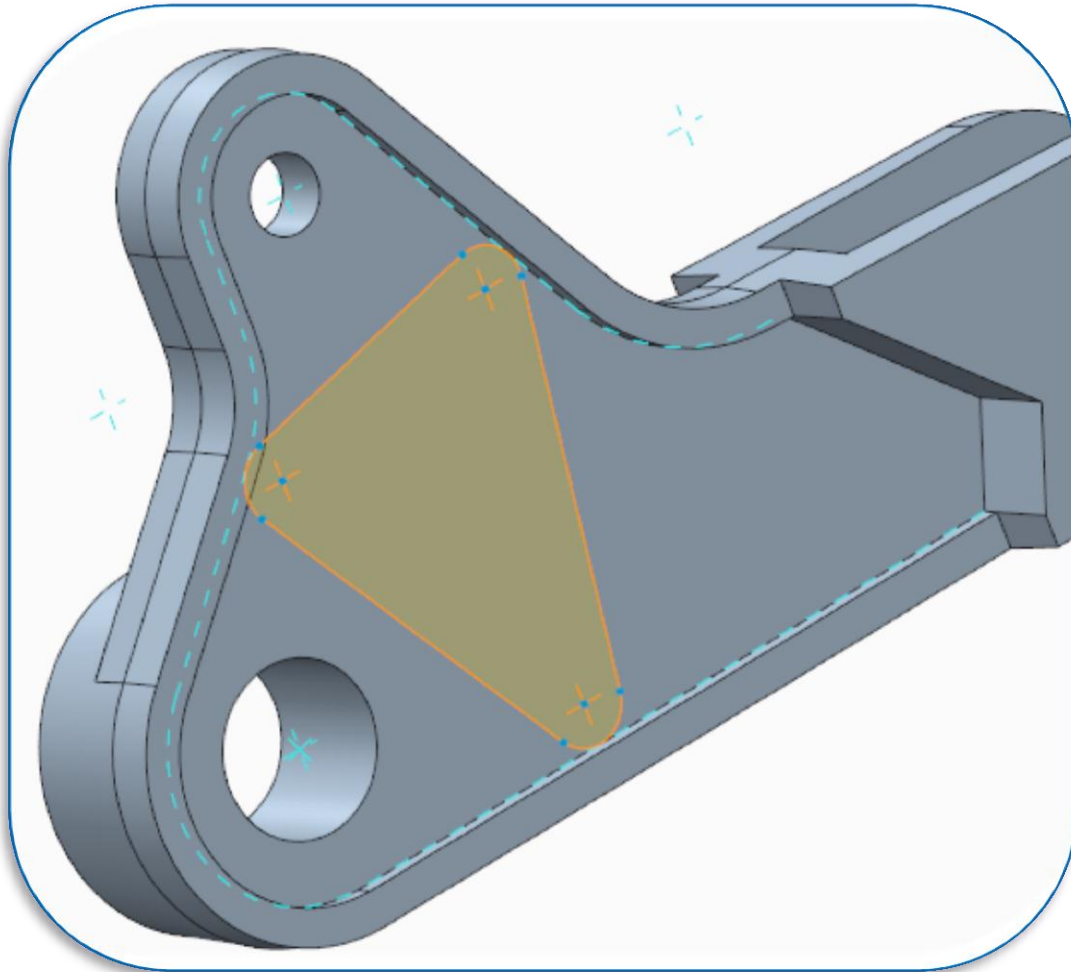
> ## > Use Query Select
> - To get intent chain as the reference in sketcher
> - To constrain sketch entities to the intent chain

References

IntentEdg:F17(PROTRUSION)
CSO:F4(CSYS)

Select | Use Edge/Offset

Replace | Delete | Solve

Reference status
Fully Placed

Close

18
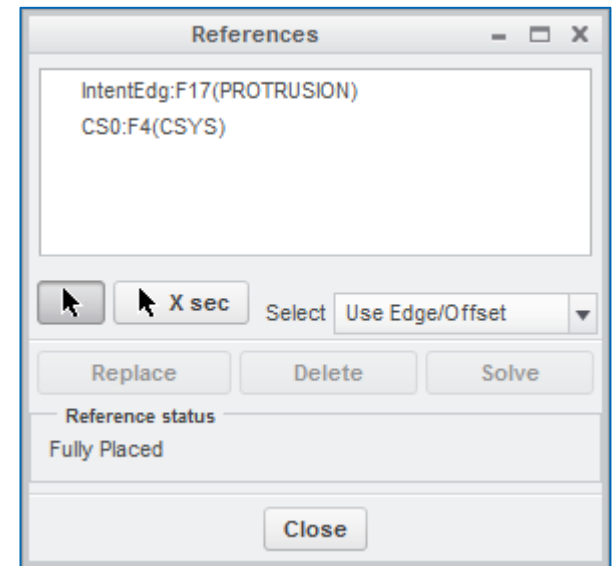
This is a Rule-Based Surface Set, NOT Intent Selection
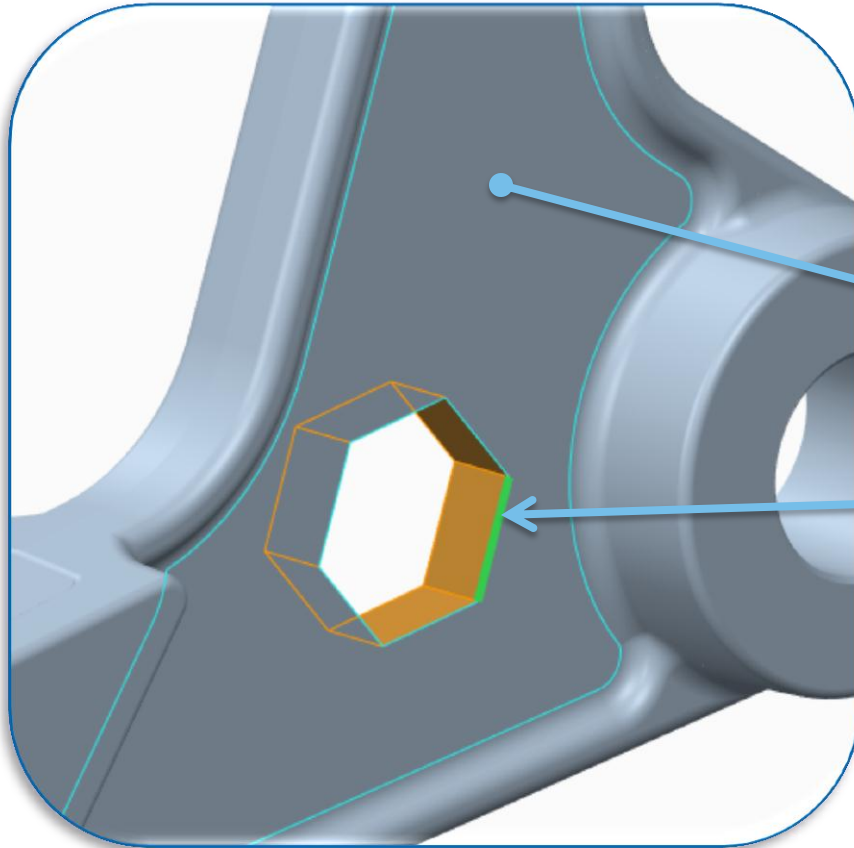
Rule-Based
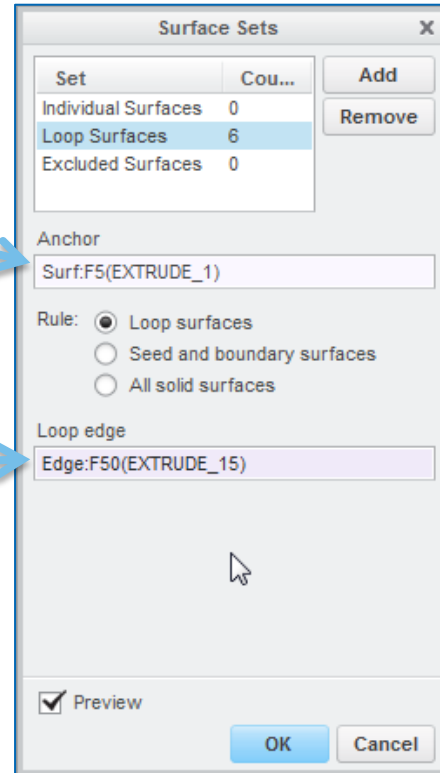
Intent-Based
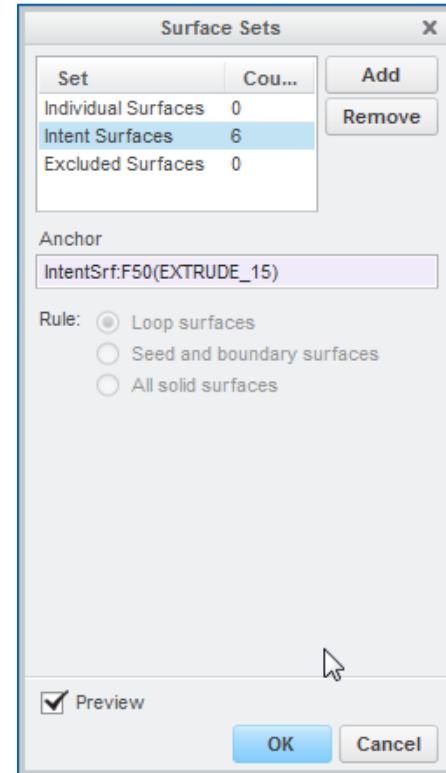
Removal of the surface or edge reference will cause the rule-based selection to fail

Let's See Intent References In Action!

Intent Reference Features

- **Use for Repeated, Complex Surface Selection**

- **Can be Useful for Top-Down Design**

- **Intent Reference Names are Searchable**
  - Use in User-Defined Features
  - Auto place without selection using intent names!
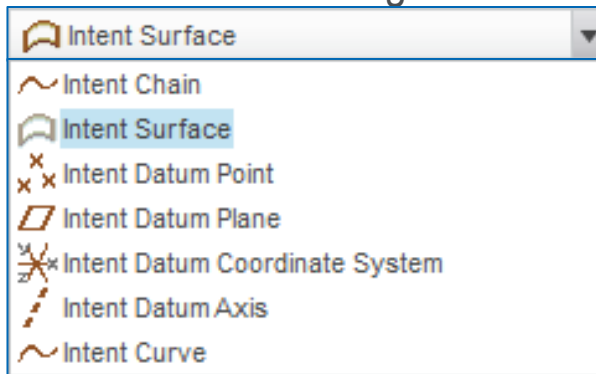
- **For Intent Surfaces, easily grab only a portion by selecting a chain boundary**

1. Create a standard reference datum in the "target" location. This can be an embedded datum in the intent reference feature of step 2 below.

2. Create an intent reference feature, referencing the standard reference datum <u>with an intent name specified</u>.

-

3. **Construct an intent reference feature with a built-in query to find the intent reference feature by name:**
   1. Create intent reference feature normally.
   2. With the collector active, use the search tool to create a search for the intent datum reference feature with the specified name.
   3. Use the "Save Query to Feature" option.

      Query will run, you will have to move the found datum from the "Found" column to the "Selected" column to click OK in the query dialog box. THE QUERY MUST WORK FOR THIS STEP TO WORK.

   4. Confirm that the query is in the collector

4. Build local UDF datums (CS4) off of the UDF(s) with the query(ies) in them.

5. Build UDF geometry off of the local UDF datums.

The Intent Datum Feature with the Datum Name set to "BOSS_INTFACE1". Contains an embedded Datum Csys, which is referenced to geometry in the target part.

The Intent Datum Feature searching for the Intent Datum Feature of name "BOSS_INTFACE1"

The Datum Feature that references the Intent Datum Feature with the internal query

Remaining datums and features reference nothing earlier than CS4.

Let's See Intent Reference Queries In Action!

Referencing Priorities in Creo

1. Use built-in intent references wherever possible and appropriate

2. Use rule-based referencing when appropriate wherever intent referencing is not available
   - The strength is in the rule!
   - The references that anchor and bound the selection rule are the weak points of rule-based references.

3. Use individual referencing (CTRL – Click)

Remember – intent references and rule-based references are re-evaluated upon regeneration – they are ALIVE!

Intent References The Reference <u>is</u> the Rule… No "Anchor" References to Fail!	Rule-Based Sets The Power is in the Rule, Weakness is the Anchor References

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