




- Does the part interfere along a known path or kinematic motion?
- Do I have enough clearance?
- Can I generate a report?
- My assembly is large. Is there a quicker way to check for interferences?
- Can I review interference checks that have previously been run?
- I want to filter out acceptable interferences (press fit objects)

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- Create the desired motion
- Create a [motion envelope](#)
- Generate the interference/clearance analysis using the motion envelope
- Use PTC CreoView for improved performance and reports

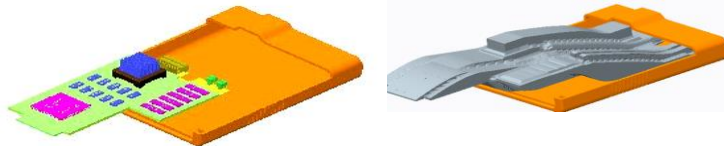
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- PTC Creo Parametric 2.0 or higher is recommended with Advanced Assembly module
- Mechanisms 
- Animation 
- Snapshots 
- CreoView

- PTC Creo Parametric
 - Creation of a **Motion Envelope**
 - Using Mechanisms
 - Using Animation
 - Understand Assembly constraints
 - How to set up so that you can drag components
 - How to drag components
 - How to set collision settings
 - config.pro: ENABLE_ADVANCED_COLLISION YES
 - Interference/Clearance checks
- PTC CreoView
 - Interference Checking – quick and simple
 - Interference categories – Accept, reject, in work...
 - Interference reports- create, compare and share

What is a Motion Envelope?

- A motion envelope is created as a solid using Shrinkwrap capabilities.
- A frame file (.fra) captures a range of motion of a set of data
- Shrinkwrap uses the frame file to create the model



- Our goal is to create this motion envelope
 - Yes, the motion envelope is a tessellated part

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Defining Motion in an Assembly

3 basic methods to define motion

- **Dragging components**
 - Must leave open degree(s) of freedom (Packaged Components)
 - Collision settings can be set to
 - Stop motion
 - Push other parts (as long as they are also packaged)
 - There are no limits to the motion outside of collision settings
 - Motion must be manually controlled
 - No set position for regeneration (Snap back to the start location upon regeneration)
- **Mechanisms**
 - Must leave an degree of freedom open (Packaged Components)
 - Collision settings can be set to
 - Stop motion
 - Push other parts (as long as they are also packaged)
 - Limits can be applied to the motion
 - Motors and other drivers can be applied to drive movement
 - Set regeneration location (models snap back to a set regeneration state)

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3 basic methods to define motion

- **Snapshots**

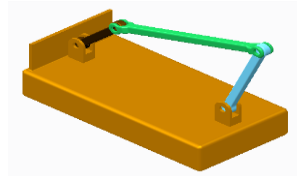
- Are not technically a movement tool in it's self
- Captures the current location of all components
- Can be used in drawings
- Are used in the Animation module to define motion
- Animation mode will blend between the Snapshots to create the motion envelope part.

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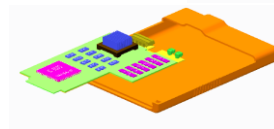
3 Examples

Defining movement for a motion envelope

- **Kinematic (Manual and Mechanism driven)**



- **Dynamic (Mechanism driven)**



- **Snapshots (Animation driven)**



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Live Demo

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Conclusions

- There are several tools to create the motion envelope
- Motion envelopes help identify areas of concern.
 - More refined checks may still be required.
- PTC Creo Parametric interference tools are great but have some limitations
 - You must use simplified reps to limit what is being checked
 - The interference information file is the only report
 - Large assemblies can have long retrieval times
- PTC CreoView can be useful in an interference checking
 - Can review interferences without PTC Creo Parametric
 - Reports are stored in the .pvs file
 - Review and update interference status
 - Other tools such as markup can be useful in identifying to others areas of concern

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- The following slides are steps used during the presentation.
- The content files can be downloaded and used to learn these techniques

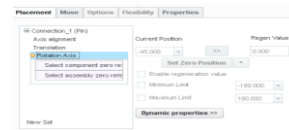
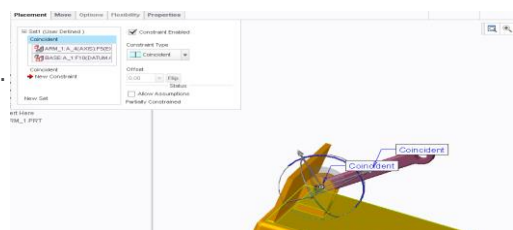
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Motion Envelope for Kinematic Mechanism

Assemble the first component.

Define the connections

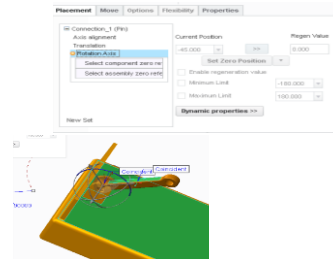
- There are multiple ways of making the mechanism.
- In this case use align the axis and center the part
- This leave a rotation degree of freedom
- **Tip:** Turn off assumptions for axis alignment so that the component is packaged
- Pick the mechanism icon to convert to joints
- Drag the component to see if it is going to behave correctly



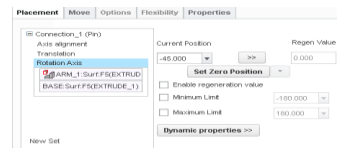
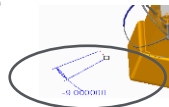
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Assemble the first (driver) component.

- Define the behavior
 - Select the Rotation Axis option
 - Select the surfaces that will define the angle Measurements
 - Notice now you can set values
 - Zero Position
 - Enable regeneration
 - Minimum and Max limits



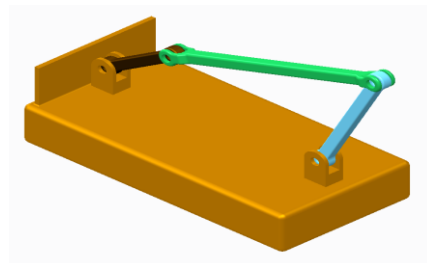
- **Tips:**
 - Setting both min and max values allows you to have the zero position in between the two values.
 - Be careful with your positive-negative values



- Verify behavior
 - Finish the assembly of the component
 - Verify the behavior by using the Drag Components command
 - Regenerate to verify the regeneration value

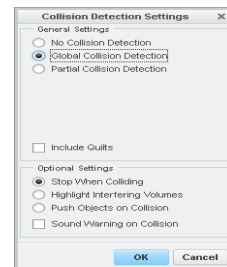
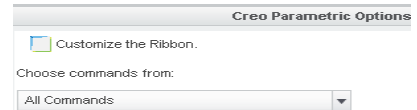
Assemble the other (Follower) components

- Assembly the other components
 - You can define mechanism joints if you want
 - You can also leave them as packaged since they just follow.
 - Verify the behavior again by dragging any of the mechanism members
 - Notice that the driver will restrict the overall movement



Collision settings

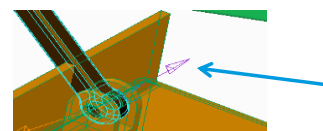
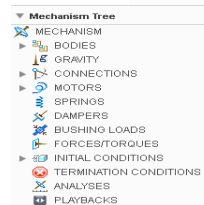
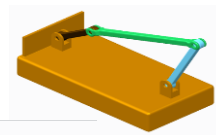
- Setting collision can be your first step in finding interference
- Getting access to the Settings
 - Add to a custom tab to get access
 - *Tip: Change the Choose commands to **All Commands***
 - Use the search command
 - Only applies to assembly mode (*yes I do get calls from users wanting to set this in part mode*)
 - Configuration file option: `enable_advanced_collision YES`
- Collision Settings
 - **Global** (all parts) or **Partial** (select the parts)
 - Stop,
 - Highlight volume or
 - push (*push requires other components to have a degree of freedom*)



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Adding Mechanism motion drivers

- Adding a Servo Motor
 - From Applications, pick Mechanism
 - You have the ribbon or Mechanism Tree to work from
 - Verify your connections by expanding the connections and joints. You should see your connection
 - Expand the Motors – see that you have no motors defined
 - Define a servo motor
 - Right click and pick new
 - See the joint on the model? Select this joint
 - Notice the new arrow, this is indicating the positive direction of motion (Right Hand Rule)
 - Apply the name of the motor
 - If you don't like the direction, you can flip the direction



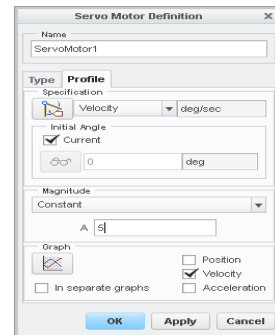
Tip: I always try make the direction of the component a positive value.

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Adding Mechanism motion drivers

- **Adding a Servo Motor**

- Once you have placed the motor you need to pick the Profile tab
- Change the Specification to **Velocity**
- I normally start with a regenerated model so I leave this as current.
- Add a magnitude
 - In this case I will use 10
- Finish the motor definition by picking **OK**

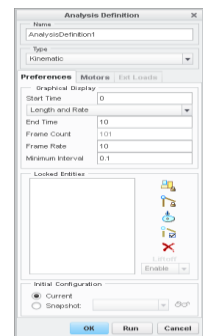
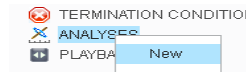


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Adding Mechanism motion drivers

- **Now from the model tree we will define the analysis of the motion.**

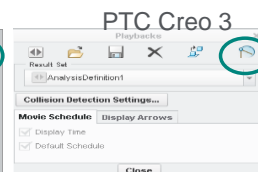
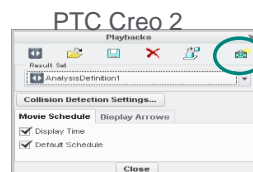
- right click on **Analysis** and pick **New**
- Enter a name
- Change the type to **Kinematic**
- Change the frame rate to 10
- Pick **Run** to see the results
- You may get an error that can be ignored



- **Define the playback (motion envelope)**

- Right click on Playback and pick Play
- Notice the analysis is already there
- Options are:

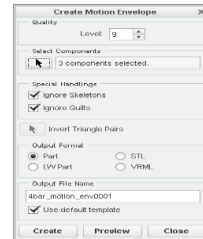
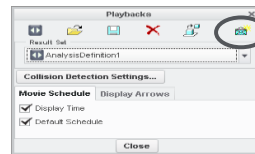
- Play the current
- Restore results from disk
- Save
- Remove
- **Create Motion Envelope**



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- **Creating the motion envelope**

- Pick the Create Motion Envelope icon
- Change the Quality level ranging 1 to 10.
 - 1 is the least detailed model (ugly)
 - 10 is the most detailed (best detail)
 - I usually use 9 as 10 takes too long
- Next pick the components that are to be included with the motion capture.
 - Only pick the parts that move (***This is very important!***)
 - Output Format = Part (default)
 - Enter a logical name (*coming up with a naming standard can help*)
 - I check Use Default template so the new part will meet your company standards.
 - 4BAR_MOTION_ENV0001 regeneration completed successfully.
 - 4BAR_MOTION_ENV0001 has been saved.
 - Pick **Create**
 - *Note your message area as the envelope is being created*
 - *You will be notified when the envelope has been created.*



- Performing analysis... 100% done
- Refining analysis... 100% done
- Performing analysis... 100% done
- Refining analysis... 55% done

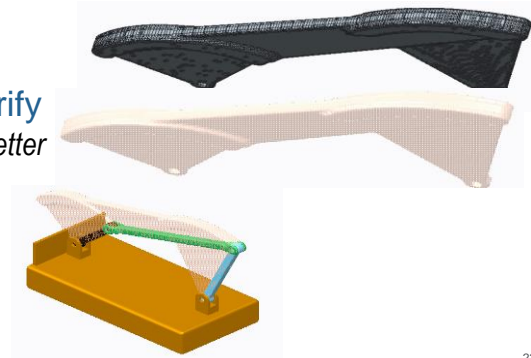
- **We have successfully created the motion envelope.**

- Close the Create dialog
- Close the Playback
- Close the Mechanism
 - If you have not saved the analysis, do so now
- Save your assembly



- **Retrieve motion envelope from disk to verify**

- **Tip:** Change the display to be without edges for better visualization
- Add color to the model with transparency set
- Assemble to your assembly to verify.
- **Tip:** Always use default constraint to assemble

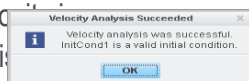
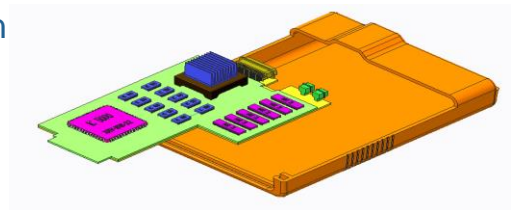


Closely simulates an assembly process than a kinematic device

- In this next example, we will assembly a component and drive motion along a defined path (curve)
- We will be defining a mechanism slot
 - Curves are required (single curve)
 - Points are required
 - Place a point on the component you want to move
 - The slot constraint requires a point on a curve
 - I add two more general constraints to keep surfaces parallel during the drag
 - You can get much more complex with multiple curves to define rotation as well.
- After the slot is defined, I create two snapshots for start and end positions.
 - We will be using the snapshot in the next step
 - Dragging has no regeneration component location and snapshots will help restore the component location.


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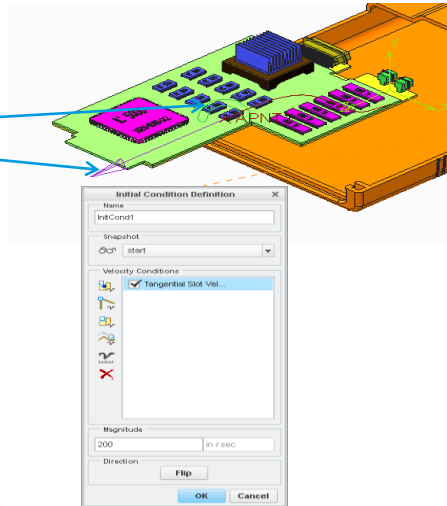
- Place the component in the starting position
- Go to Applications, Mechanism
- Create Initial Conditions
 - From the Mechanism Tree right click and pick **New**
 - Assign a name as desired
 - Change to the Snapshot **Start**
 - Then pick the Velocity
 - You should get this



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- **Defining the Tangential Velocity**

- Select the tangential velocity icon 
- Select your slot definition from the model
- Make note of the direction arrow and flip as necessary
- Add a magnitude that will move the component
- In this case we will make it 200
- Pick **OK** to finish

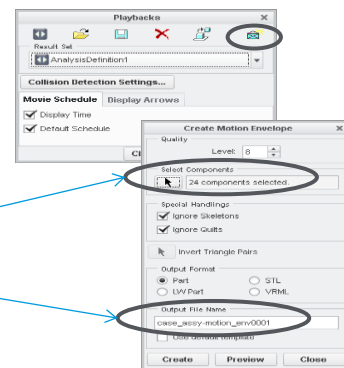


- **Create Analysis**

- Right click on the Analyses and pick **New**
- Change type to **Dynamic**
- Select **IC (initial condition) State** and pick your initial condition if necessary. (See *Create Initial Conditions in previous slide to understand where this came from.*)
- Pick **Run** and **OK** to finish the Analyses

- **Define the Motion Envelope**

- Right click on Playbacks and pick Play
- You will be in the Playbacks screen
- This is the same set of data that you had for the kinematics motion envelope.
- For this case we will just create the envelope
- Change the level and make sure that you only include what you want to be part of the motion envelope?
- Always check the Output filename as well
- **Tip:** The output file will always go to the workspace for PDMLink sessions or your working directory.



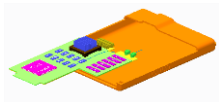
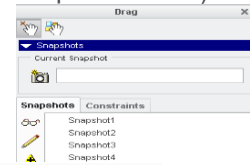
- **The motion envelope**

- Open the envelope and assign a color and transparency setting
- Assemble the motion envelope

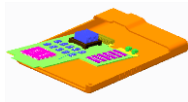


Motion Envelope Using Snapshots

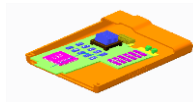
- If you don't have access to Mechanisms, you still can create a motion envelope by using snapshots
- Snapshots are very useful in various functions
 - Captures components in current locations
 - Can be flagged for use in a drawing (great for showing components in multiple locations)
 - Also used by the Annotation application to create a motion envelope.
 - Created in the Drag Components icon



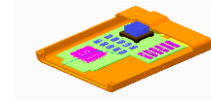
Snapshot1



Snapshot2



Snapshot3



Snapshot4

Motion Envelope Using Snapshots

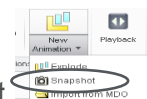
- In this example, I have already created the snapshots 1-5
 - To create these, I assembled to the curve but left an extra degree of freedom open so that I could rotate the model as well.
 - I just created the snapshots along the path
 - When you are done, you must remove the component constraints to allow the animation to work.



- Go to Applications and pick the Animation icon

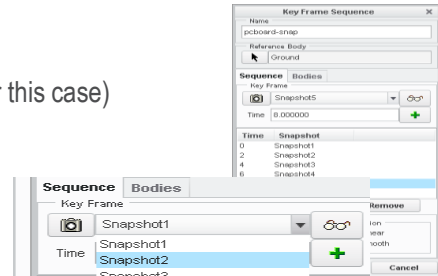
Creating the animation

- By default, the system creates an explode based animation. We want a snapshot
- Select New Animation and choose the Snapshot option
- Enter the animation name
- From the animation tree, right click on the default animation and delete it.



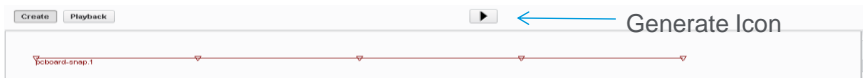
• Creating the animation

- Next select the Key Frame Sequence
- Give the sequence a name
- From the Key frame pick your first snapshot (Snapshot1 for this case)
- Time is left at 0(zero)
- Pick the add (green plus sign)
- Go back to the Key frame and pick the next snapshot
- Change the time to 2 (we are sequencing from 0-10)
- Pick the add icon again
- Repeat this process for each snapshot increasing the time by 2 for each snapshot
- After you have the snapshots, I always change the interpolation to smooth



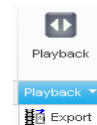
- Regenerate and then OK to finish the sequence
- Note: *You can add more than one sequence and time them to play in sequence.*

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• Creating the animation

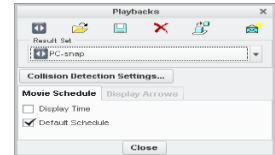
- Next we will use the Playback section to create the envelope
- First pick on the arrow in the middle of the playback. This is the Generate icon
- *You should note that the playback timing now has a new background.*
- You can also move the timing of the snapshots by dragging them
 - Be careful to keep the timing fairly consistent
 - Very short times will give you odd results
 - If you change the timing, you must generate the animation again
 - You can also export the playback to a movie by expanding the playback icon and exporting the playback



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- **Creating the envelope**

- Finalize the motion envelope by picking on the Playback icon
- This will give us the same screen for creating the Shrinkwrap for the motion envelope
- Follow the same instructions making sure that you only pick what you want to be part of the animation.

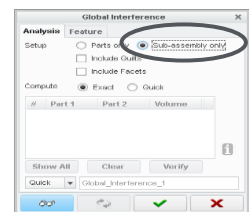


- **Assemble the envelope**

- Open the envelope
- Modify colors and transparency
- Assemble the motion envelope to the assembly
 - **Tip:** *It is often best to create a separate assembly for the analysis*

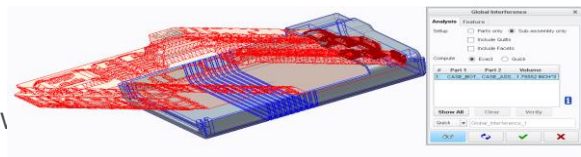
- **Standard interference check**

- Global Interference
 - Found under the Analysis tab
 - With normal assembly checks you usually start with sub assemblies and check the part to part interference
 - As you move up the tree, you need to change the option to Sub-assembly only
 - Note: *This option will pick up parts within the current assembly*



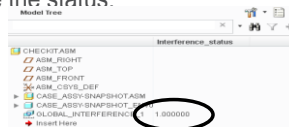
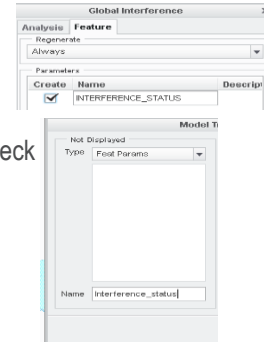
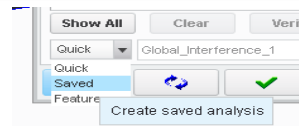
- **Setup for motion envelope check is required**

- Need to eliminate the parts used to create the motion envelope
- You can use simplified reps to do so.
 - Set Exclude as the primary state
 - Add only what you want to check
- The display with the motion envelope can be
- The interference can get lost in the view



- Standard interference check

- Once you have the results you can save the analysis
 - Saved analysis has to be rerun
- You can also create a feature.
 - Feature is used to create a parameter if there is an interference or not
 - This parameter can be shown in the model tree.
 - Pick Feature and go to the Feature tab
 - Check the box for Interference status and complete the interference check
 - Open the model tree columns
 - Change the type to Feat Params
 - Type in the name: Interference status and push this to the Columns
 - After picking OK, you will see the status.
 - 0= no interference
 - 1= interference



- Standard interference check

- For each run of an interference check you get the list of all interferences
- You can save this output to a file using the Display Info icon



INFORMATION WINDOW (qbintr.dat)			
File	Edit	View	
Save			
Save As...			
Close			
		Part 2	Volume
r1:	BOARD_TOP-HOTION	IC200-HOTION	0.000288000 INCH^3
r1:	BOARD_TOP-HOTION	IC200-HOTION	0.000288000 INCH^3
r1:	BOARD_TOP-HOTION	IC200-HOTION	0.000288000 INCH^3
r1:	BOARD_TOP-HOTION	IC200-HOTION	0.000288000 INCH^3
r1:	BOARD_TOP-HOTION	IC200-HOTION	0.000288000 INCH^3
r1:	BOARD_TOP-HOTION	IC100-HOTION	0.000144000 INCH^3
r1:	BOARD_TOP-HOTION	IC100-HOTION	0.000144000 INCH^3

- This is the same information that you get from the global_intf.inf file found in your working directory.

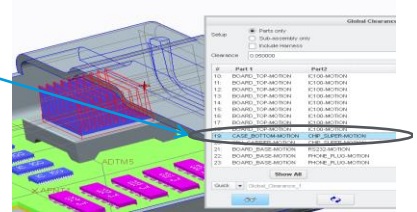
Clearance checking in PTC Creo Parametric

Checking Clearances can be just as important as checking interferences

- Clearance checking options in PTC Creo Parametric

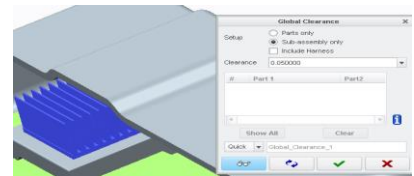
- Global Clearance
- Pairs Clearance

Actually a clearance



- Global Clearance

- Not much use for measuring clearances for a range of motion
- Checks all parts for clearances
- If you think about wanting to check clearances, you will get a lot of items in the list using this option
- I have never seen what the actual clearance is using this option
- It also lists interferences mixed with clearances so it is difficult to determine what is what.
- If you switch to Sub-assembly only option, you run the chance of missing clearances.



Interference/Clearance checking in PTC Creo Parametric

Checking Clearances can be just as important as interferences

- What's missing in this solution?

- May be difficult to eliminate original assembly components
- Restricting the parts to be checked usually requires a simplified rep.
- May require long regeneration time to just start the interference check
- The motion envelope is difficult for display and gives you very slow responses.
- Only one report on the interferences. No way to mark a desired interference verses something that needs to be corrected.
- No real compare reports exist that I know of
- On complex assemblies, finding clearances can be difficult

Just a quick overview

- Lightweight viewer for CAD models
 - Takes a 10th of the time to retrieve
- You can save into a PTC CreoView format or just read the PTC Creo Parametric files
- Free versions will allow you to share with vendors
- Easy to use
- Various functions such as:
 - Markup
 - Measure
 - Exploded views and sections
 - BOM
 - Compare
 - ECAD compare
 - **Interference checking**
 - Animations

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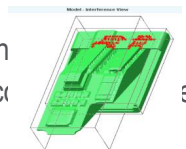
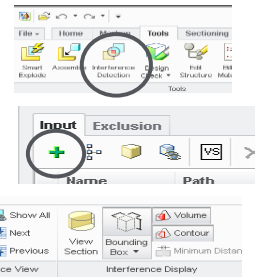
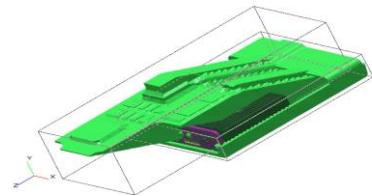
- **Tips on setting up PTC CreoView Recipe file for PTC Windchill PDMLink**
- Quick retrieval of assemblies
- Easy control over display of parts
- Different type of clearance check
- Reports

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Interference Checking in PTC Creo View

PTC CreoView Interference checking

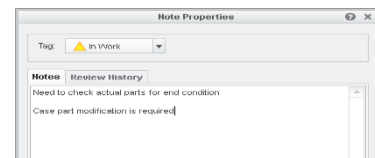
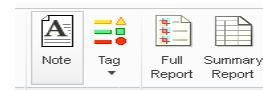
- Open the model you want to check
- Select the components you want to include with the interference check
 - In the case of the case_assy-motion.asm we only want the **motion envelope** and the **case**
 - From the Tools tab pick the **Interference Detection** option
 - From the settings dialog, pick the plus sign to add the models to the detection.
 - Then pick calculate
 - You will now see that there is one interference
 - Select the interference and pick the show on ribbon
 - You can now see the interference



Interference Checking in PTC Creo View

PTC CreoView Interference checking

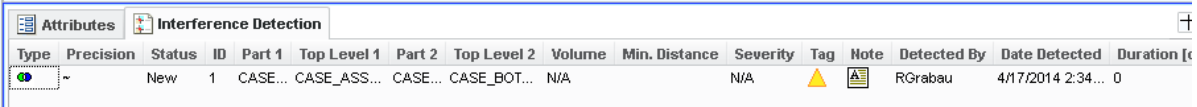
- Notice that there are options for reports
- To prepare a report you must save the detection
 - From the ribbon pick Save
 - Give the report a name
 - You will now see that you have more options in the ribbon
- You can add notes and tags to the interference
 - Pick Note
 - Change the Tag to represent the status of the interference
 - In this case I picked In Work
 - I also added notes to the report



Interference checking in Creo View

PTC CreoView Interference checking

- From the interference check you have a list of information



Type	Precision	Status	ID	Part 1	Top Level 1	Part 2	Top Level 2	Volume	Min. Distance	Severity	Tag	Note	Detected By	Date Detected	Duration [d
~		New	1	CASE...	CASE_ASS...	CASE...	CASE_BOT...	N/A		N/A	▲	📄	RGrabau	4/17/2014 2:34...	0

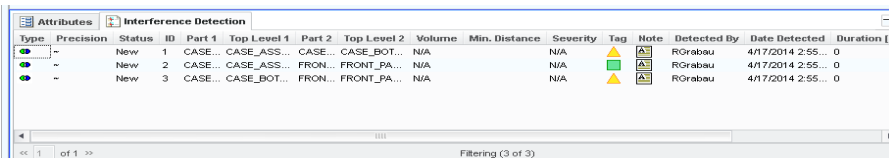
- Also you can review the report by picking on Full Report
 - This gives you lots of information about the interference check
 - You can add filters to change the reporting
 - An export option allows you to export the report to csv or webpage formats
- Lets run another interference but this time we are going to add the front panel to the report
 - From the model tree pick the front panel for display
 - Pick the front panel and then pick Detection from the ribbon
 - Pick the + sign to add the front panel
 - After picking calculate you will find that there are 3 interferences now.



Interference checking in Creo View

PTC CreoView Interference checking

- Save the interference as before
- Select each interference and add notes and tags as appropriate.
- Note that there is a filter option at the bottom of the view
- You can filter out approved items and such as necessary



Type	Precision	Status	ID	Part 1	Top Level 1	Part 2	Top Level 2	Volume	Min. Distance	Severity	Tag	Note	Detected By	Date Detected	Duration [d
~		New	1	CASE...	CASE_ASS...	CASE...	CASE_BOT...	N/A		N/A	▲	📄	RGrabau	4/17/2014 2:55...	0
~		New	2	CASE...	CASE_ASS...	FRON...	FRONT_PA...	N/A		N/A	▲	📄	RGrabau	4/17/2014 2:55...	0
~		New	3	CASE...	CASE_BOT...	FRON...	FRONT_PA...	N/A		N/A	▲	📄	RGrabau	4/17/2014 2:55...	0

Filtering (3 of 3)

PTC CreoView Interference checking

- Now that we have more than one report, we can use the Compare option

- Select the compare option
- The active interference report is automatically added to the compare
- Additionally since we only have one other report, this is automatically added.
- You could select other reports if they existed to compare
- From here, I may want to save the compare so select the save option
- Pick Compare from the tool tray
- Enter the name and then the compare button
- Here is an example of the compare for this case

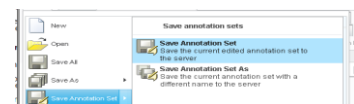


Attributes			Interference Detection					
Type	Precision	Status	ID	Part 1	Top Level 1	Part 2	Top Level 2	Volume
•	-	Exists	1	CASE...	CASE_ASS...	CASE...	CASE_BOT...	N/A
•	-	New	2	CASE...	CASE_ASS...	FRON...	FRONT_PA...	N/A
•	-	New	3	CASE...	CASE_BOT...	FRON...	FRONT_PA...	N/A

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PTC CreoView Interference checking

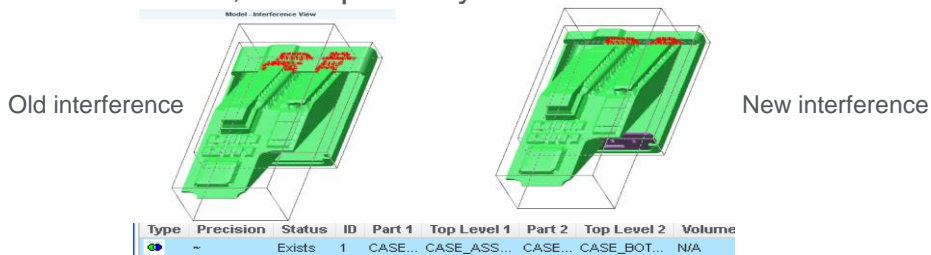
- We need to discuss the notes and tags a bit more
- Notes and tags are considered Annotations.
- You must save annotations so that you can review them later
 - Annotation sets must have a different name than the interference check
 - *Tip: Recommended name is to keep it the same as the interference but with a dash (-annotation)*
- Annotations are a bit different than the interference query
- You retrieve annotations from the tabs above the model tree



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PTC CreoView Interference checking

- When updating the PTC CreoView file, all the annotations and interference queries are retained
- Running a new interference will allow you to compare to an existing query
- One major limitation is that if two parts interfere on both reports but have different interferences, the report only shows Exists.



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- 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

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