

ZW3D

***Advanced Assembly Animation
Training Guide***

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ZW3D™ V2014 Advanced Assembly Animation

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Forward

The full version of the ZW3D documentation is available by selecting **Help Browser** from the **ZW3D Help Menu**. Go to the "**Program Folder\doc**" directory on the ZW3D program directory and open the file "**ZW3D.chm**".

This **Advance Assembly Animation Training Guide** is available as a printed manual and in PDF format. To view or print the PDF version, install the Adobe Acrobat Reader and open the corresponding files in the "**Program Folder\PDF**" folder in the program directory. Refer to the **HELP Manual** for information relating to specific tasks.

NOTES:

1. For best results, view and print the PDF version of the documentation using the Adobe Acrobat Reader.
2. Since the **Advance Assembly Animation Training Guide** is only a portion of the complete documentation, it is highly recommended that you utilize the **HELP Manual**. You will find additional topics, more information on command options, input options, additional command notes, and cross-links to related tasks and topics.
3. It should be noted that the HELP Manual will always be more up-to-date than any printed or PDF material. If you find any discrepancies between the two, always refer to the HELP Manual.
4. While you are working with ZW3D, simply press **F1** to view the documentation about the command you select.

To help you customize your CAD/CAM requirements, please contact our Customer Support department on our website <http://www.zwsoft.com/> or call at (8620) 38289780 ext 565 . You can also contact your local sales representative or application engineer to discuss your requirements.

Thanks for being our customer!
Team ZW3D

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Chapter 1 Introduction

Creating animated assemblies with ZW3D begins with the animation object. An animation object is a target object that is owned by the assembly. There is no access to the animation outside of the assembly. It will not show up in the Root Object Browser. This is similar in concept to a sketch that is owned by a part.

Access to **Assembly animation** is through the Assembly Tab.



New animation



Edit animation



Inquire animations



Delete animation

You can create simple or complex animations with or without the use of a camera. Using a camera, you can animate the viewpoint of the animation. This allows the creation of "fly-through" animations by changing the camera location at desired keyframes in the animation. Shown below are two simple animations created with and without a camera.

- When an animation is created, a "snapshot copy" of the relevant entities in the assembly is made. From that point on, changes to the assembly are not reflected in the animation and changes in the animation are not reflected in the assembly. Changes to the component parts, however, will still be reflected in both the assembly and the animation.

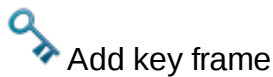
There are two basic scenarios for animation:

1. Assembly is Fully Constrained – No degrees of freedom remain – Can't drag the components.
2. Assembly is NOT Fully Constrained – There is still a degree of freedom in the mechanism – Can drag the components.

We will talk about both in the following chapters.

- Alignments, wireframe geometry, datum planes, lights and many other entities can be created and edited within the animation. All of these edits are local to the animation. This allows a mechanism to be designed as an assembly with a degree of freedom left. Within the animation, a “driver” constraint can be added and animated without affecting constraints in the actual assembly.

The first major concept to understand no matter which type of animation you are going to build is **KeyFrames**.



Add key frame



Delete key frame

A **KeyFrame** is a “Key” Frame in the animation. It defines a time in the animation when Animation Parameters or specific movements are given explicit values. Parameter values vary linearly from one keyframe to the next so that if a vise jaw separation parameter is 0mm at the start and is 100mm 5 seconds later, the separation will be 50mm at 2.5 seconds into the animation.

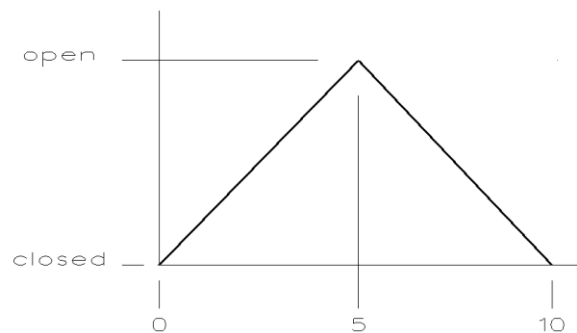
An **animation parameter** is a value that is allowed to vary during the animation. The most common example of a parameter is the value of an assembly dimension. For instance, the distance between the jaws of a vise can be varied during the animation by setting values for the assembly dimension at the keyframes. When animated, the assembly dimension becomes a “parameter” of the animation.

The first two icons to the right of the **ZW3D Animation Manager** (shown above) are for creating and deleting keyframes. The pulldown at the top of the manager shows all of the keyframes and can be used to set the current time of the animation.

Deleting a keyframe deletes all the parameter values that have been set at the keyframe. Below is an example of a simple animation that contains three keyframes.

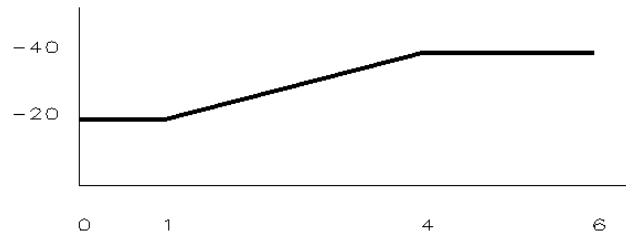
The start of the animation is defined at keyframe 0 and the mechanism is closed. At 5 seconds the mechanism is open. At the end of the animation (10 seconds) the mechanism is closed again. This could be a door opening and closing. The animation parameter would be the angle of the door relative to the wall.

It is a good idea to layout a similar time line for your animation. Define parameters that you want to control during the animation and their values. Include times that you want the camera angle to change.



Example 1 - KeyFrame Time Line

The next example is a 6 second animation with 4 keyframes. The angle of a mechanism is set to be -20 degrees at one second and -40 degrees at 4 seconds. The angle will be a constant -20 degrees for the first second of the animation. It will then linearly change from -20 to -40 over the next 3 seconds and will remain constant until the end of the animation.



Example 2 - KeyFrame Time Line

- Extrapolating parameter values – A key to understanding how a parameter will change during an animation is understanding the graph of the parameter versus time. Currently, the rules for constructing the graph are very simple;
 - Linear change between keyframes where the parameter is set.
 - No change (i.e. constant value) before the first and after the last keyframe where the value is set.
 - For example, if in a 10 second animation, the vise jaw separation distance is set to be 25mm at 2.5 seconds and 100mm at 5 seconds, then the distance will be a constant 25 mm for the first 2.5 seconds of the animation. It will then linearly change from 25 to 100 mm at 5 seconds and will stay at 100 mm for the rest of the animation.

Chapter 2 Fully Constrained Assembly

1. Open the file “toggle_clamp.Z3”.
2. Select **Assembly_1** from the object preview window.
3. Click on the **Inquire** command shown below left.  You will notice that the Flange is anchored and the other components are “Well Defined”. This indicates that if you were to try and **drag** the assembly, it will not move.

4.  New Animation. Click the New Animation through the Assembly Tab.

The animation manager is a tab on the ZW3D Manager that organizes the parameters and keyframes of the animation and collects all of the commands for manipulating and viewing the animation in a single easy to use format. The animation manager does not display all of the potential parameters that are animatable in the assembly; it only displays the parameters that are actively being controlled by the animation.

5. Set the length of the animation 0:10 would be interpreted as 10 seconds.

You now have 2 **keyframes** automatically defined.

The **Start** (time 0:00) and the **End** (time 0:10).

Let's define a parameter at the current keyframe 0:00.

6. Select **parameter**. 

Adding/Deleting Parameters – Parameters can be added to the animation by either directly editing entities or by using the “Parameter” icon on the animation manager. The famous vise separation distance can be added as a parameter to the animation by editing the dimension value in any of the ways you are used to in the assembly (double-click the dimension, Edit->Dimension Value (from the menus), Edit existing alignments (from the assembly Tab)), or by using the “Parameter” icon. Using the “Parameter” icon will display

all of the editable parameters in the assembly. Deleting a parameter will cause the parameter to quit changing during the animation and will set the value of the parameter to the value that it had at the beginning of the animation. Note that adding a parameter will automatically create a keyframe at the current animation time if one does not exist.

There is a list of all the constraint parameters on this assembly. **We want to animate the angle of the Handle.** You will notice two identical constraints: **Align11_d4(Pln/Pln)and Left side flange.1 >∠Align11_d4** in the Input Manager. This is actually the same constraint; it is just shown attached to both components it controls. (The Left side flange and the handle.)

7. Pick either one and <middle-click>.
8. The **Input Dimension Value** menu pops up and we are going to accept the default value.
9. Pick **OK**.

Our first parameter has been added to the animation at keyframe 0.

Let's create another keyframe at 5 seconds to match our example time line.

Adding Keyframes – The icon KeyFrame of the Animation Tab are for creating keyframes. Deleting Keyframes – right click the keyframe of the animation manager and choose Delete key frame . Deleting a keyframe deletes all of the parameter values that have been set at the keyframe. So, if the vise jaw separation was set to 0 mm, 100 mm and 75mm at times 0 seconds, 5 seconds and 10 seconds respectively, deleting the keyframe at 5 seconds would delete the value of 100 mm at 5 seconds and the separation would now linearly change from 0 to 75 mm over 10 seconds.

10. Select **Key frame**. 

Enter the time 0:05, click OK. We are now at keyframe 0:05 and our first parameter is still shown and the angle is still at 0.

11. Double-click the value and change it to 45.

Setting/Clearing Parameter Values – Once a parameter has been added to the animation, there are several ways to set the value. The value can be changed by any of the usual edit methods. It also can be changed by double-clicking or right-clicking the parameter on the animation manager or by using the “Set value of parameter” icon on the animation manager. Parameters that have been set at the current keyframe will have a tag for their icon on the Animation manager. Note that setting the value of a parameter will automatically create a keyframe at the current animation time if one does not exist. Clearing a parameter at a keyframe lets the value at that keyframe be defined by the values at neighboring keyframes. For the affected parameter, clearing the value has the same effect as deleting the keyframe. Of course there is no affect on the other parameters that are set at the keyframe as would be the case if the keyframe were deleted.

12. Double click the Keyframe 0:10.to activate or right click and choose Activate.

We are now at the last keyframe and we want to return the clamp to its original position.

13. Double-click the value and change it to 0 again. Our animation will last 10 seconds.

The angle of the handle relative to the Flange will go from 0 to 45 and back to 0.

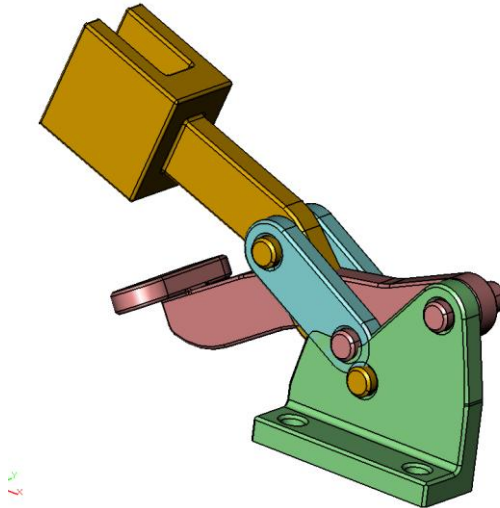
At the middle of the animation manager are the playback controls.

We are currently at the end of the animation.

The **current animation time** is displayed at the bottom of the animation manager. The display of the assembly depends on the current animation time. The animation parameters are interpolated between the values that are specified at the keyframes to determine their current values and these values are assigned to the assembly which is then solved. The assembly resulting from these values is then displayed in the graphics area while the current values for the parameter are shown in the list area of the Animation Manager.

There are several ways to **change the current animation time**. It can be set by explicitly typing a new value in the current animation time field, changing the current keyframe using the keyframe dropdown list, or by using any of the play controls at the bottom of the animation manager.

14. Select the **Start of animation** button . You are now at keyframe 0.
15. Select **Play animation** . If there are no questions, that is **the end**....



Not so fast...

We just pushed the Handle down through the mechanism. This won't pass inspection on the shop floor.

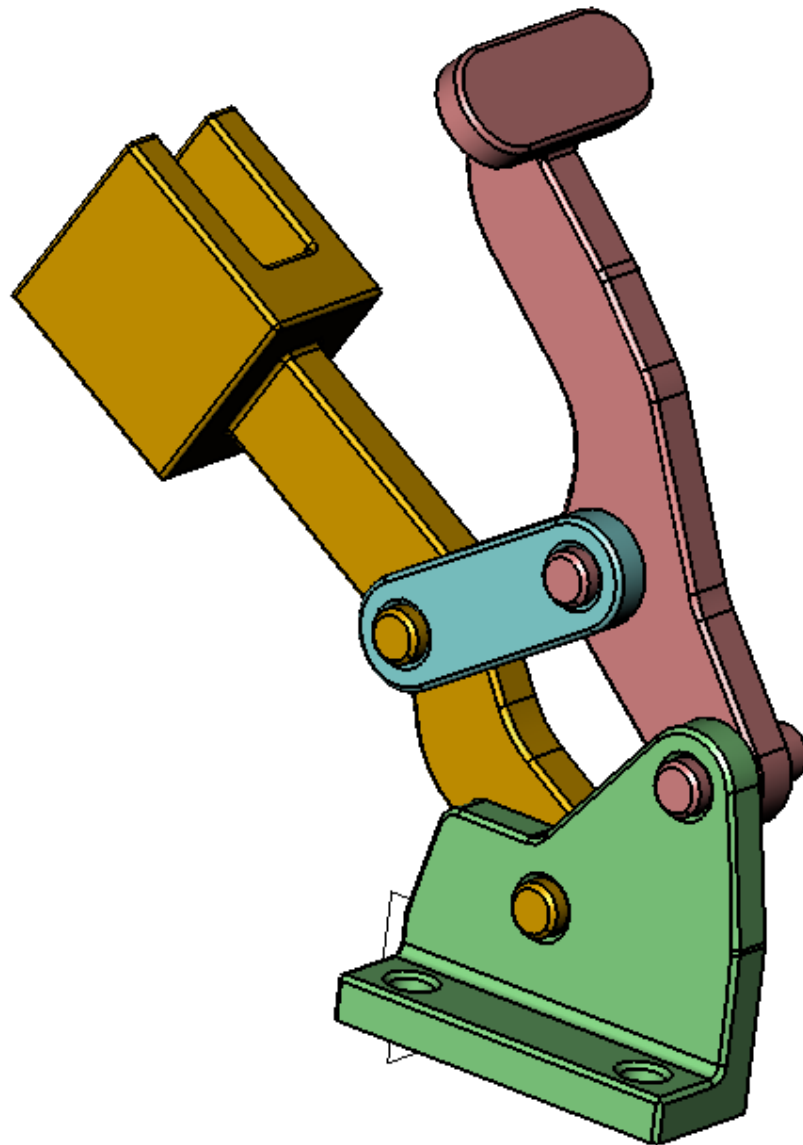
We ...I mean, you must change the angle in the middle of the animation from 45 to -45.

16. Select keyframe 0:05.
17. Double click on the value and change to -45.
18. Select the Start of animation button .
19. Select Play. 

Animation Parameter Values – An animation parameter does not need to have a value specified at every keyframe. For example, the vise may open and close many times during the animation while a nearby conveyor belt runs continuously. Every time the vise opens and closes, the jaw separation dimension will need to be set requiring several keyframes. The dimension driving the conveyor belt, on the other hand, can be set at the beginning

and end of the animation with no need to specify values at the keyframes that are needed to drive the vise jaws. When a parameter has a value set at the current keyframe, a “tag” is shown on the icon for that parameter in the Animation Manager’s parameter list.

This looks better.



Animation at 5 seconds

There are other playback controls that you can experiment with other commands.



If you pause the animation you can see what the value of the parameter is at that time.

You can change the time explicitly by typing in a time value. Try 0:04.

20. While the animation is paused, click on the Repeat button  and Play .

- What is animatable
 - Assembly component positions
 - Assembly alignment dimension values
 - Assembly alignment state (whether alignment is enabled and thus affecting the animation)
 - A camera that controls the view of the animation
- What is NOT animatable
 - Shape and wireframe positions that are not part of a component whether created in the assembly or the animation
 - Lighting (other than through “Component light sources”)
 - Attributes such as color, transparency, etc.
 - The “anchor” state of a component. Anchoring/un-anchoring a component anchors/un-anchors the component throughout the entire animation
 - The existence of any entity or the shape of a component.
 - The “blank” state of any entity

Let's add a camera definition to our animation.

21. Hit the **Pause** button. 

22. Select **Key frame 0:00** or .

For this example let's change to the front view. 

23. Select the **camera position** icon. 
24. Select the **Current view** button under Input manager.
25. Select OK. The camera angle is now set for Keyframe 0.
26. Activate **Key frame 0:10**.
27. Rotate the view or zoom in/out.

You can use the Dynamic Viewing capability: F2 , F3 Keys.

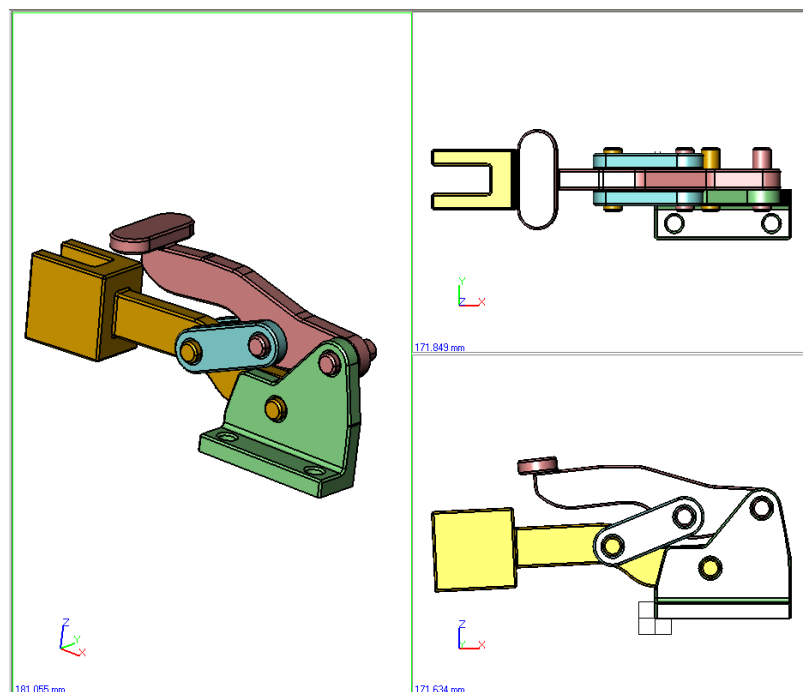
28. Select the **camera** icon again. 
29. Select the **Current view** icon again and **OK**.

The Camera is now set for the end of the animation.

There are a couple of viewing techniques you may not be familiar with.

30. Select the VIEW pull down > Layout > and any of the optional layouts from the menu.
31. Click in each view port and set the view orientation to your liking.

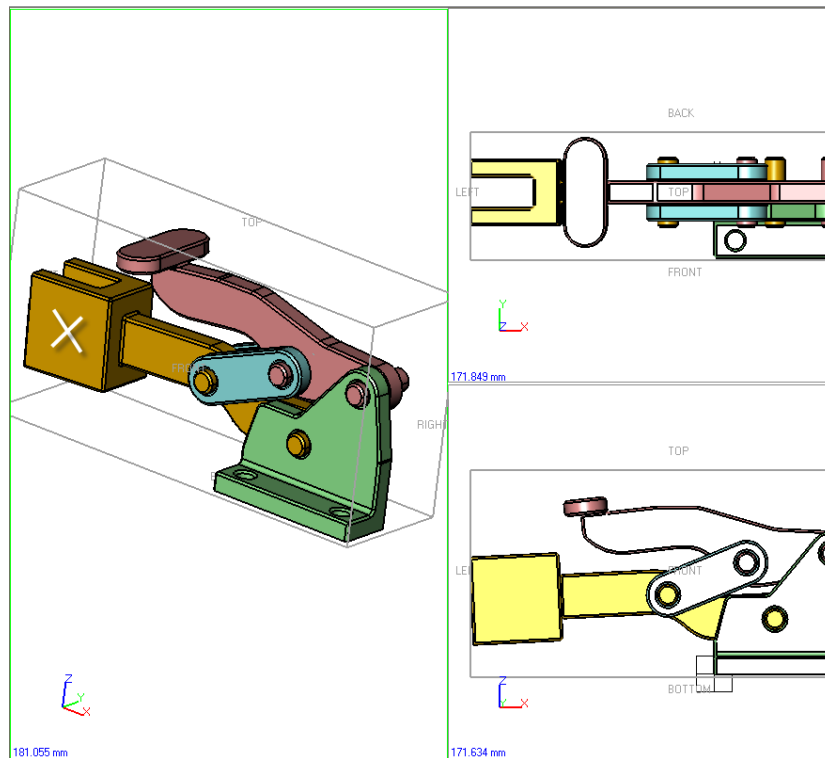
The last view you click in is the active view. This is the only view port the camera will change.



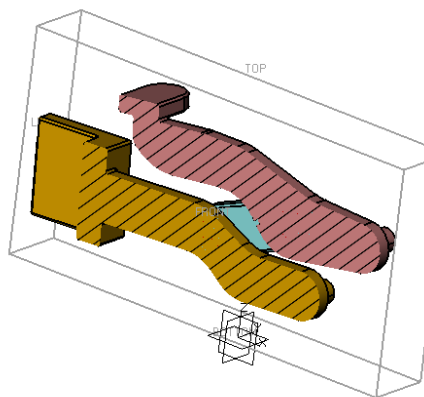
32. Another viewing technique is to use the “**Section View**” command. 

33. Pick in the left hand view as shown below. 

The pick is actually on the block surrounding the assembly.



34. Drag the view to about the middle or type **0** and click **OK**.



This is a good time to talk about interference.

35. Use the view controls on the Document Awarred Toolbar to reset the view to either wireframe or shaded view. 

36. Use the View pulldown > Layout > Fullscreen to return the view ports to the original single view.

Chapter 3 Not Fully Constrained

1. Open the **Assembly_2** object.

This is a copy of Assembly_1.

2. **Right-click** on the last alignment “Align11” in the History window and **Delete** it.

3. We now have a degree of freedom and can “**Drag**” the handle.

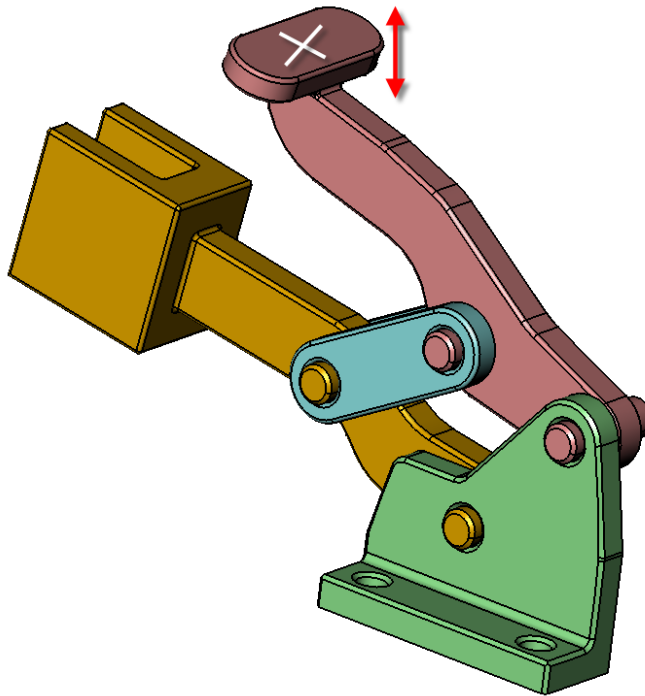
4. Select the **Drag** command.



5. Select the face indicated below and drag the Handle to see a range of motion.

6. Cancel this command.

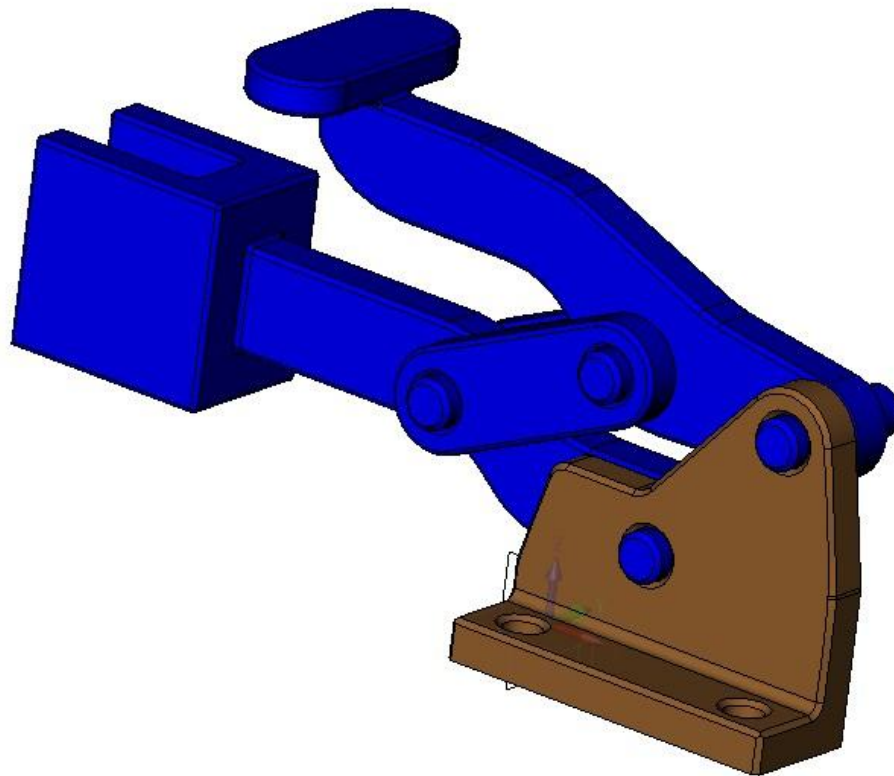
This is essentially what we are going to do in our next animation.



7. Click on the **Inquire** command under the Assembly Tab.



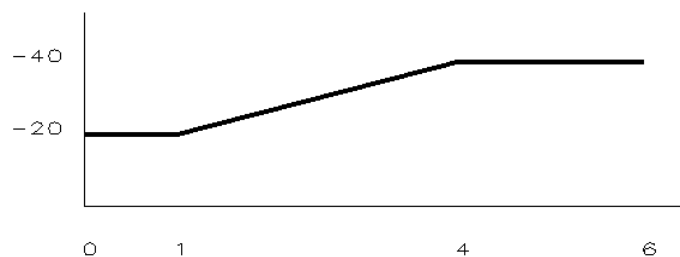
This is another way of verifying that we have at least one degree of freedom in our mechanism. Instead of being **Well defined** the mechanism is **Under defined**.



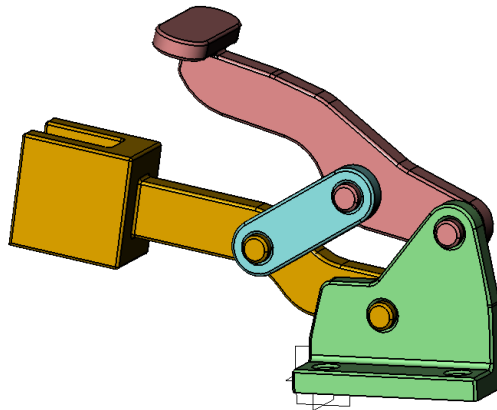
8. New Animation. 

9. Set the length of the animation to 0:06 seconds.

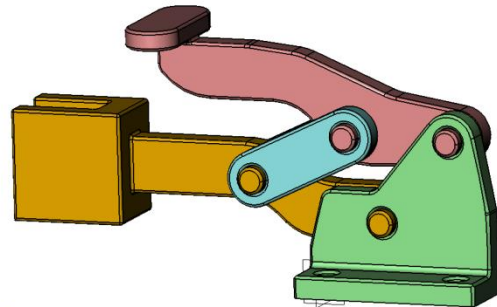
Remember the second example of the timeline. Let's use that as a template.



10. Set the view to the angle you want to view the animation. F2, F3.



11. Select the Drag command and move the mechanism to the start position.

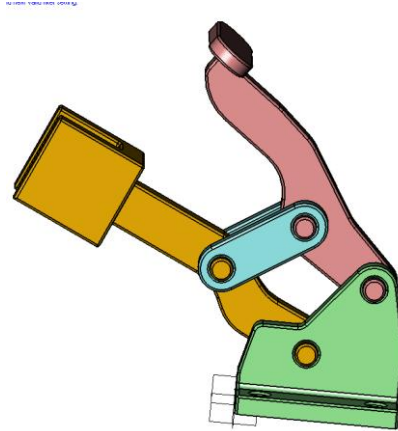


12. Define camera position.



13. Add a Keyframe at one second.  We are not going to change a parameter here. We want a constant value for the first second of the animation.

14. Add a Keyframe at 4 seconds . 



15. Drag the clamp to open it more.

16. Select Keyframe 0:06. Again we are not going to change the angle of the clamp.

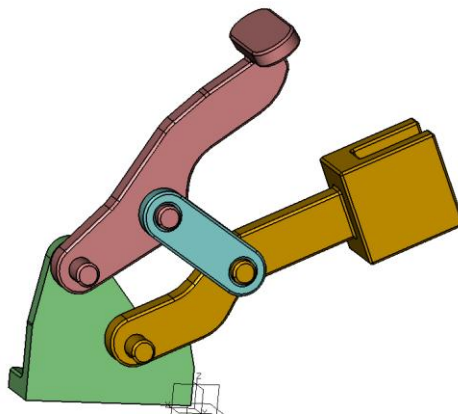
But we will change the camera angle.

17. Use F3 to rotate the view to the back.

18. Define camera position. 

19. If you want to send the animation you just made to a client, open the **Animation** Tab.

Click on the Record animation button at the end of the Tab. 



Lock at Previous Keyframe toggle – This toggle on the animation manager can greatly reduce the amount of work needed during creation of an animation. When this toggle is

pressed in, it is assumed that the animation is in its desired state at the previous keyframe so that any changes at the current keyframe will result in linear changes from the previous keyframe, but the scope of the change will not extend past the previous keyframe. This is achieved by automatically setting the value of the parameter being modified at the previous keyframe. With the vise jaw distance example, assume that we are working on a 10 second animation and that the jaw separation parameter has not been added yet, but the separation happens to be 50 mm as it was in the parent assembly. With the current time at 5 seconds, adding the separation parameter and setting its value to 100 mm will result in an animation where the jaw moves from 50 mm to 100 mm over the first 5 seconds of the animation. This is because of the assumption that everything was as desired at the previous keyframe (0 seconds). If you were to set the time back to 0 seconds, you would find that the value is “tagged” even though you never explicitly set the value at 0 seconds. This mode works great for incrementally adding to the end of an animation. Get everything looking great at the current keyframe, then create a new one and make changes with the confidence that the parameters that you are changing will not affect the animation at the previous keyframe (or earlier). You will want to turn this mode off when you understand the graph of a parameter and you want to change it somewhere in the middle of the animation.