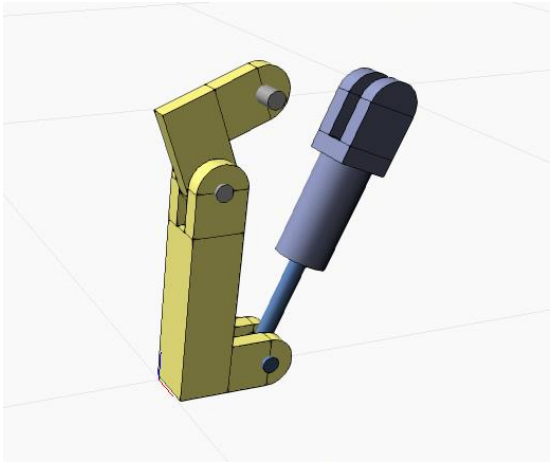
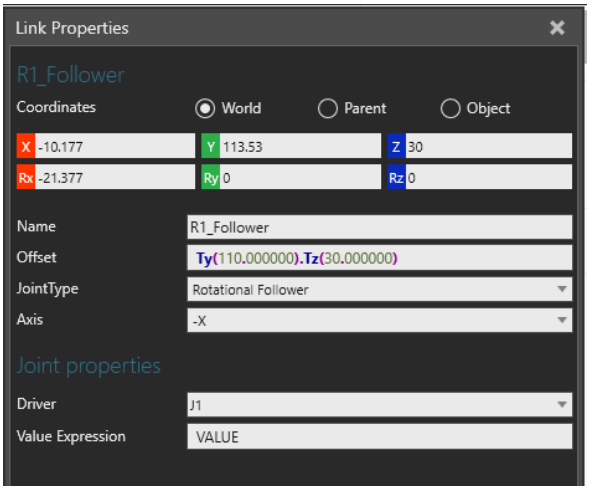
# Mechanism Wizard Add-on

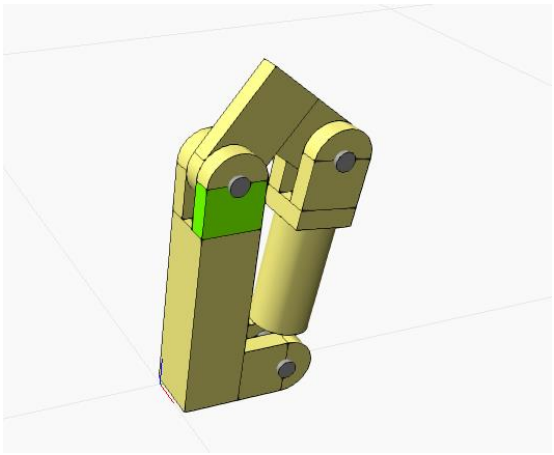
Mechanism wizard add-on for **Visual Components** can be used to solve follower joints in closed-loop kinematic chains where you have 1 driving joint and 2 follower joints. Solution for follower joints is based on sasa-functions (topic “Functions” in VC help) which are helper functions for solving triangles and quadrilaterals. The images below show an example mechanism before and after using the wizard.

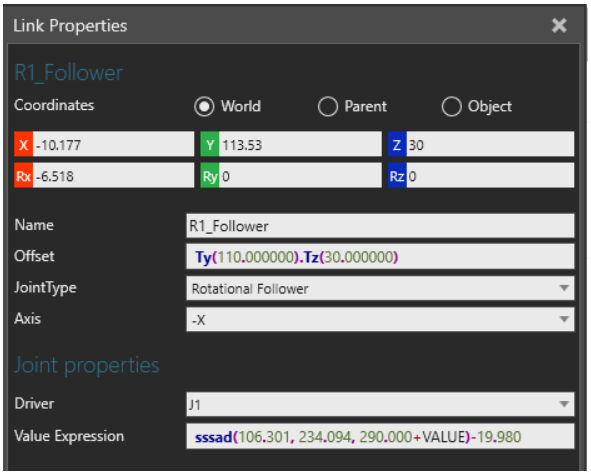
**Before**





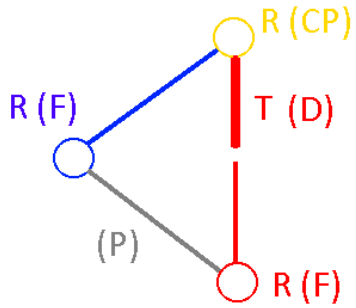

**After**





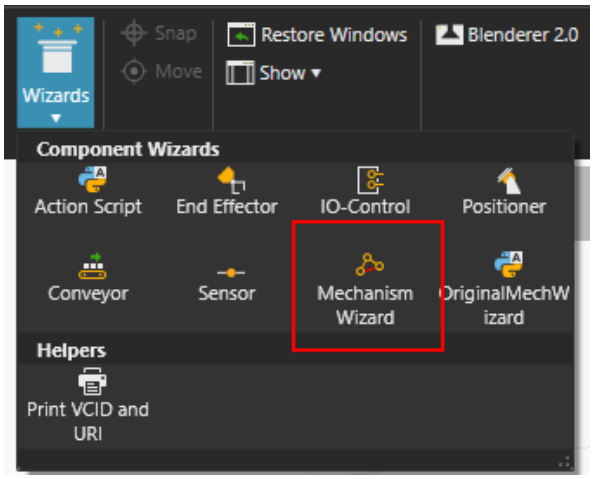
# Prerequisites

- 2 link chains which have a common parent node.
- One chain has 2 moving links and the other has 1 moving link.
- There is a common connection point where both open chains meet.
- There is one driver joint and two follower joints.
- System forms a triangle where all corner angles (R: Rotational joints) and one side length (T: Translational joint) variate.
- Rotational joints must be parallel (signs can be different) and translational joint must be perpendicular to rotational joints.
- Specific system types which the add-on supports are listed under **Supported systems.**

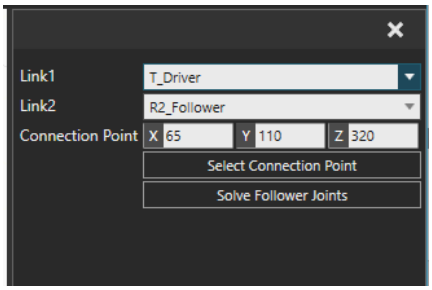



# How to use

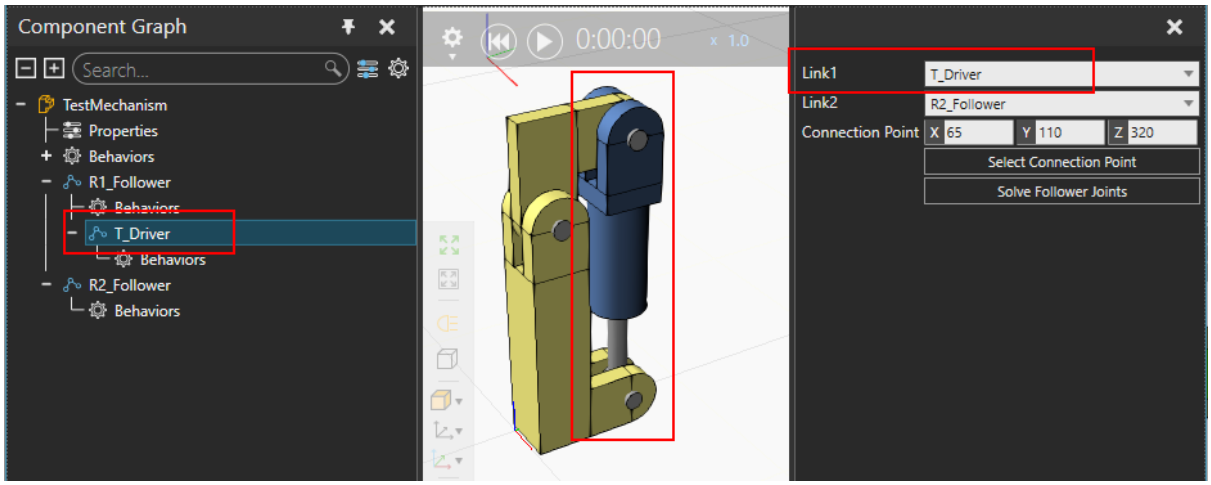
To install the add-on copy add-on folder under your **Documents\Visual Components\4.X\My Commands** folder. This will add a new button under Modeling tab and Wizards menu.

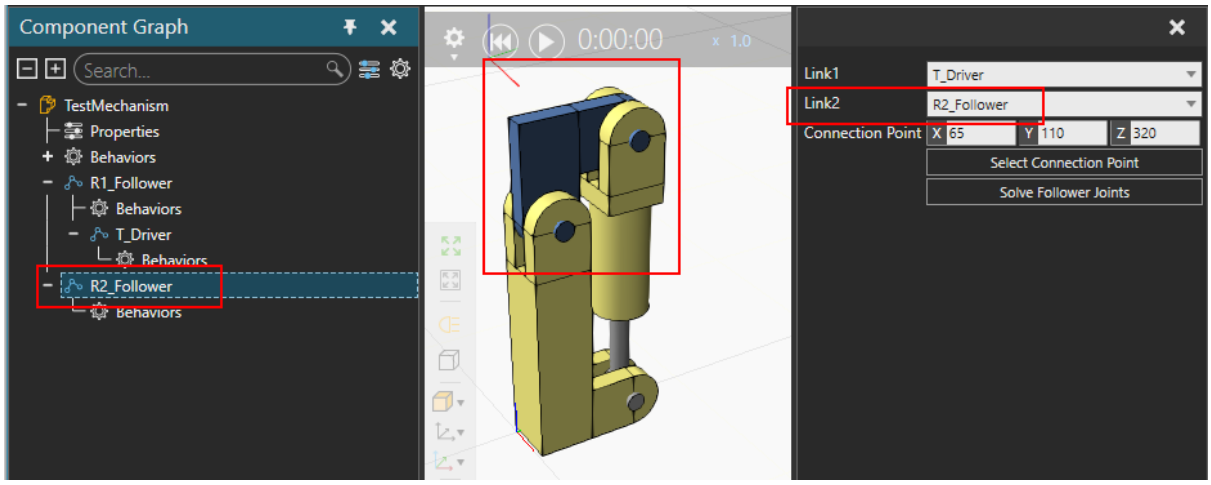


Before you use the add-on make sure that you have modeled 1 driver joint and 2 follower joints and that the model fulfills the prerequisites. Add-on contains few example models that are prepared for using the add-on. With component selected launch the add-on and that will open a property panel where you select some parameters.

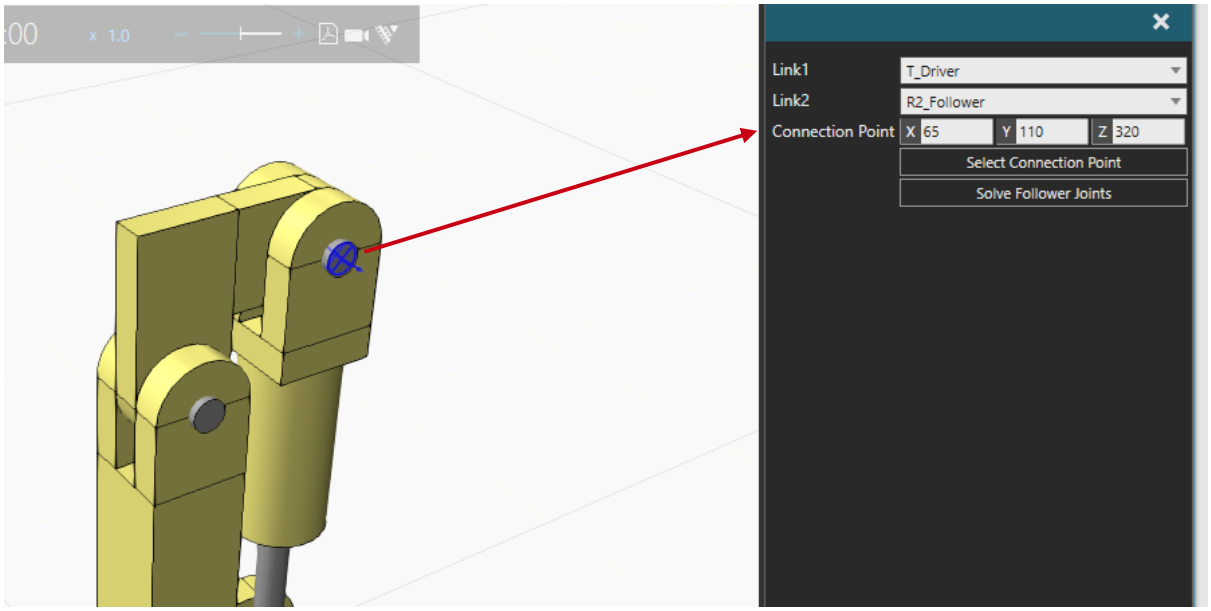



For **Link1** and **Link2** select the ends of two link chains that should be connected. Images below show an example of this.



After selecting links select **Connection Point** coordinates in component origin. It is possible to type coordinates manually but it is usually easier to click **Select Connection Point** button and select position in 3D model. After selecting the point on 3D its coordinates are displayed in **Connection Point** parameter.



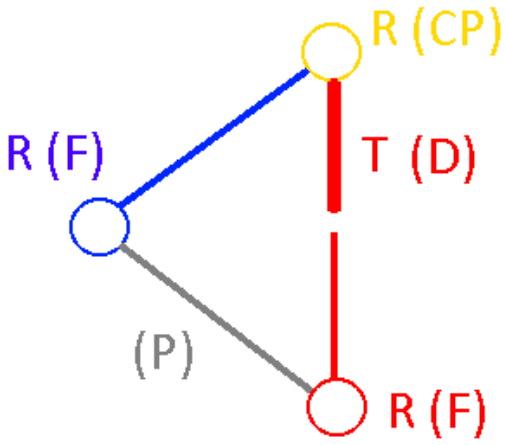

Finally click **Solve Follower Joints** button to execute the solver. If everything is a success the add-on formulates expressions for the followers. Expressions are written in links and they are also shown in the output console. After that you can test the mechanism to see if the expressions work and if the system appears as closed loop mechanism.

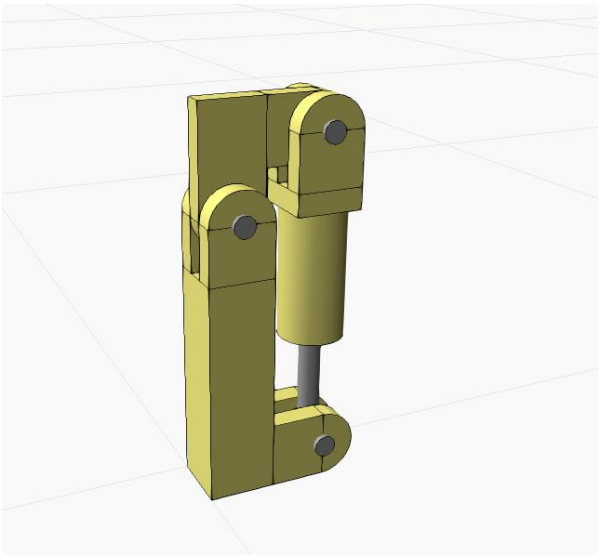
```
System type: TRR (Triangle)
Follower 1, R1_Follower: sssad(106.301, 234.094, 290.001+VALUE)-19.980
Follower 2, R2_Follower: sssad(290.001+VALUE, 106.301, 234.094)-111.203
```

# Triangle vs Quadrilateral

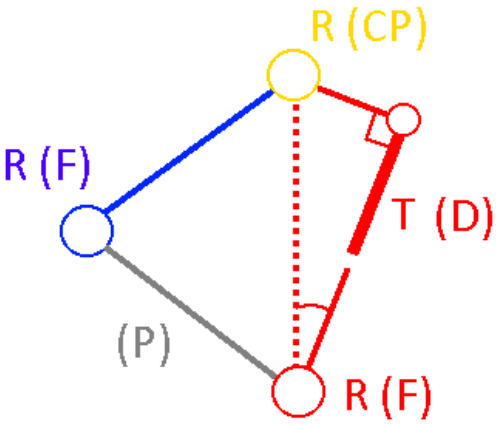
Often the mechanism of 3 rotational joints and 1 translational joint is built so that the translational joint axis pierces two rotational joint axes. In other words there is no angle between T and line formed by two Rs. Then the system is a triangle and solver uses sasa-functions for triangles. If there is offset angle between T and two Rs then the system cannot be solved as a triangle. Then the add-on tries to consider system with a fourth corner point and then you can use sasa-functions for quadrilaterals. The process of using the add-on is the same for triangles and quadrilaterals but the sets of supported systems are different. Images below illustrate the difference between triangle and quadrilateral systems.

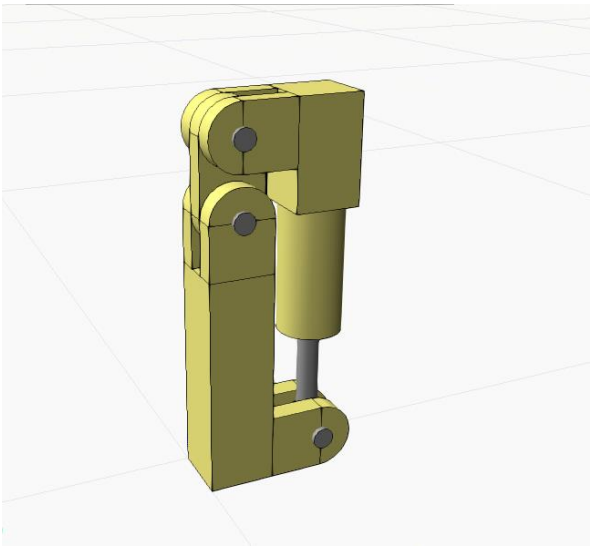
**Triangle**



**Quadrilateral**



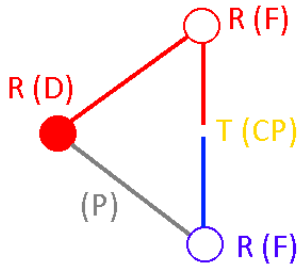



# Supported Systems

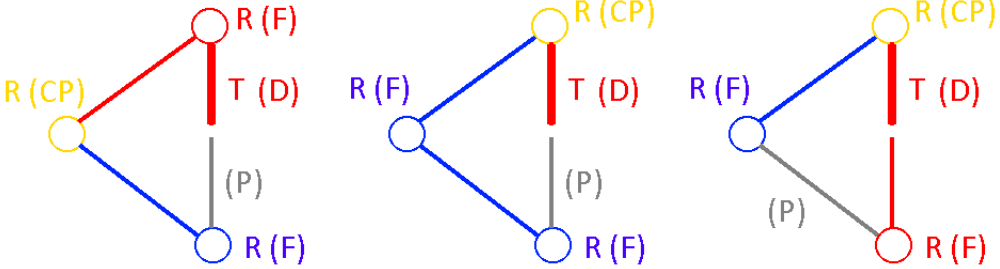
All the supported system types are listed here. In the system images R and T stand for rotational and translational joints. Common parent node is marked as (P). Driver and followers are marked with (D) and (F). Connection point which user must select is marked with (CP). Red and blue colors are used to illustrate two links chains.

**Triangles**

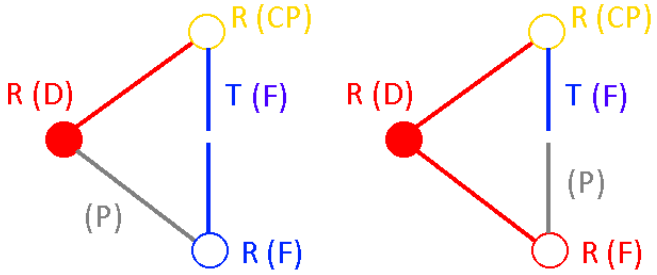
RRR (R driver, 2 R followers)




TRR (T driver, 2 R followers)

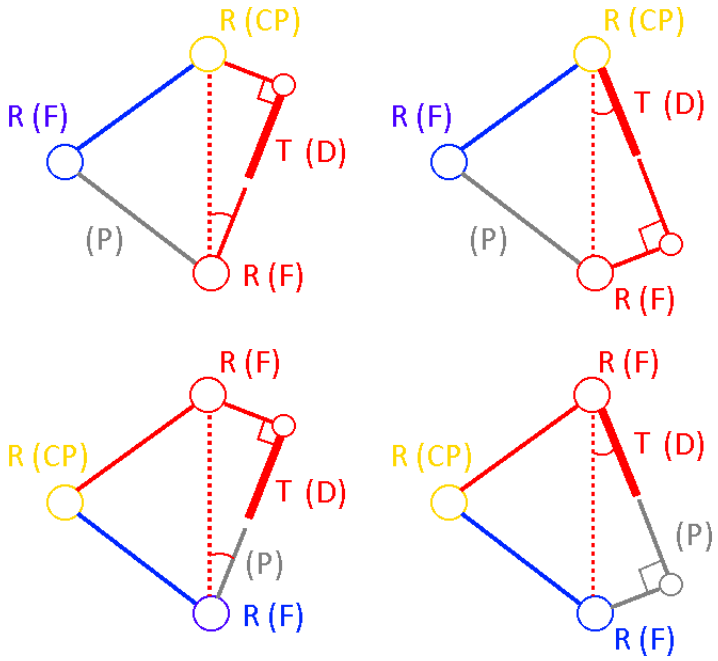



RTR and RRT (R driver, T and R followers)



**Quadrilaterals**

TRR (T driver, 2 R followers)

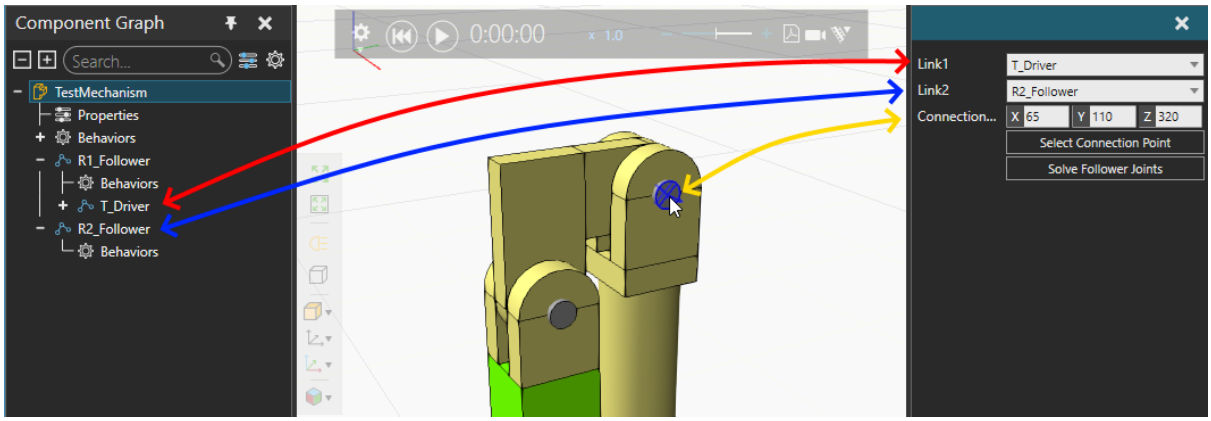


# Examples

Following example models are included in the add-on package.

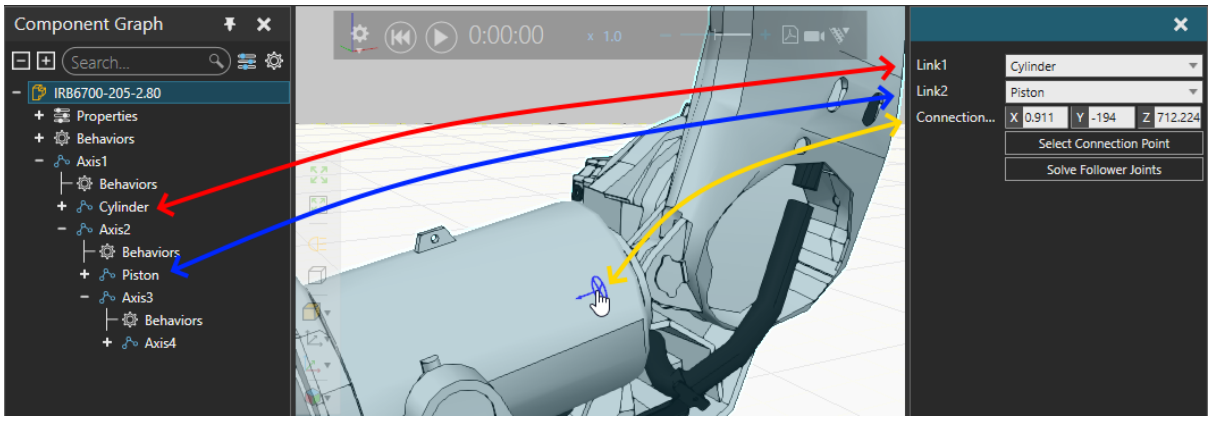
**TestMechanism**

Simple triangular TRR system that you can solve with these parameters.




**IRB6700**

ABB IRB 6700 is otherwise functional model but its counterbalance mechanism (RRR) needs to be solved. Do that with following parameters.



**TestMechanism4**

This mechanism is similar TRR system to the first example but now there's angle offset in translational joint. Solve system with these parameters.