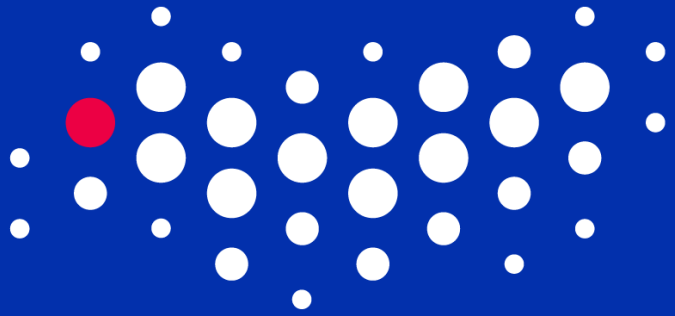


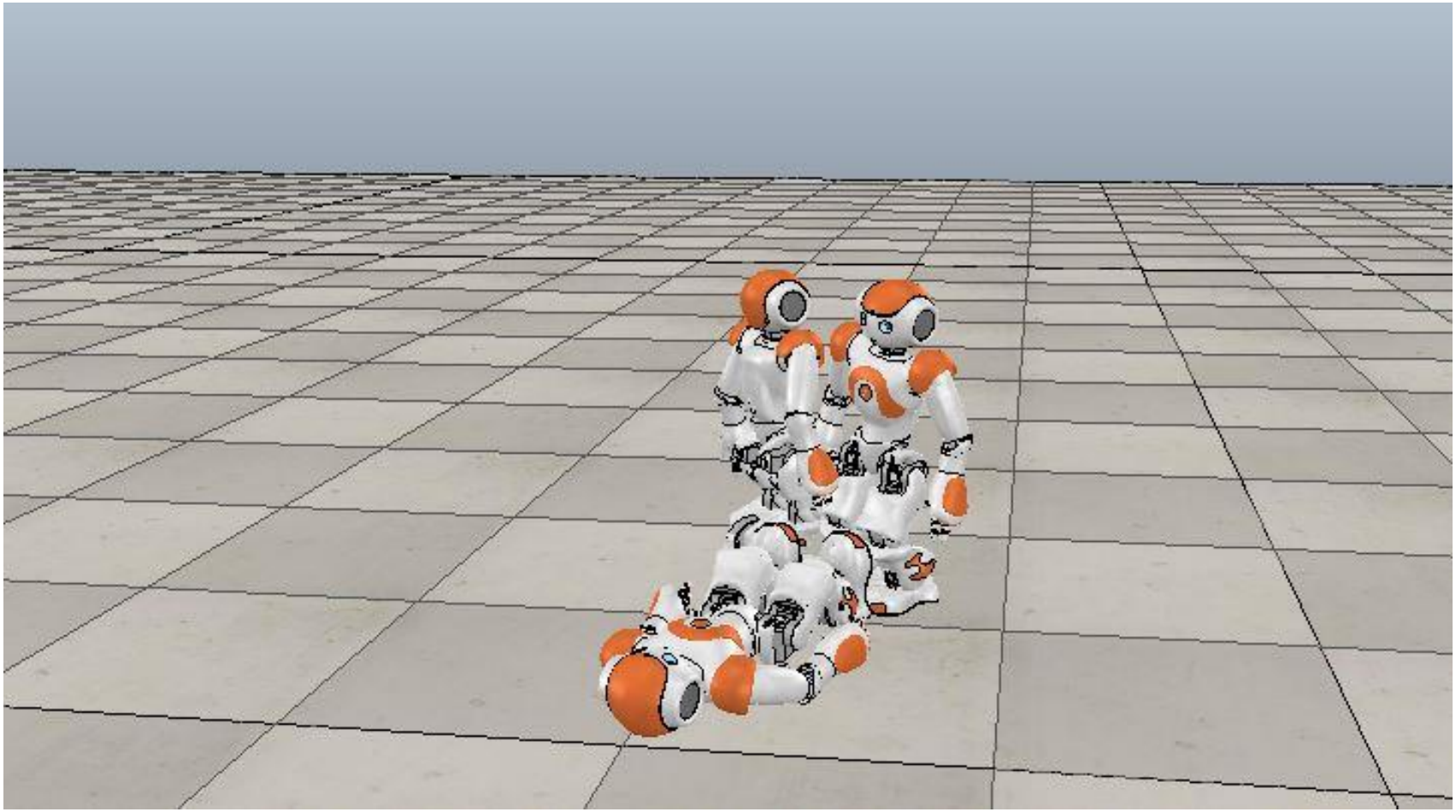
ITMO UNIVERSITY

V-REP “Hello world”

Teacher: Islam Bzhikhatlov.

St-Petersburg, 2018

“Hello world” for simulation



Prepare the model for import into V-REP

That’s easy to prepare the model in any CAD system if there is opportunity to save it in .STL format.

The references doesn't matter, we lose it while import.

But positions and orientations are saved.

When we save assembly as STL format, all files are saved separately and after imports into V-REP they will gather also as it was in the Assembly.

Before export

Choose such positions(configurations) of parts, which will be easier to collect.

Please note! Unlike to CAD systems, for simulation of physics between elements that move relative to each other, we need some small gap. Otherwise they will have an impact on each other. It is recommended to set the distance of 1 mm. Also some times we need additional element which helps to allocate axis of rotation, if you don't have any other elements for reference. That’s possible to set all data manually… but not recommended.

Features import into V-REP

If we used a simple shape such as a cube or cylinder, after import the V-REP can set the type of form "simple form" which already has a mesh. Accordingly, it is necessary to take into account at a building of model structure. Recommendation: note the icon of forms. You can also select an item in the tree and check it using the tool "object properties".

Step 1

- Create come small assembly which consists two wheels.
- Set all positions and configurations in your assembly i.e. set initial position for robotic system.
- Use command «Save as» and select format «.STL»
- Save into new folder.

Step 2

Open V-REP and execute commands: «File» -> «Import» -> «Mesh…»

- Select all STL parts in folder, set orientation correctly and scale.
- Press «OK». If the result does not correspond to your expectations it means that you entered incorrect settings in previous steps.

Step 3

- That’s necessary to rename all new components in «scene hierarchy» to make that understandable and identifiable.
- All components are just «shape» after imported which has no dynamic properties.
- We have to create new element based on our «shape» i.e. with opportunities to model dynamics.
- Select «shape» and click right button on mouse -> «Add»-> «Convex decomposition of selection» -> set parameters and press «OK».

Parameters for our Convex…

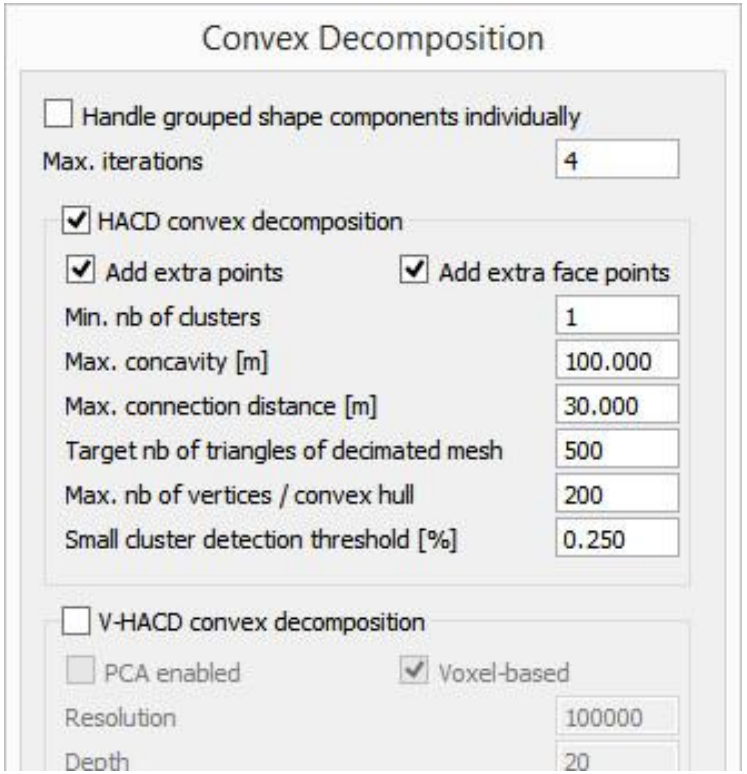
This is important to create the mesh as we need, not much angles.

Min. nb of clusters -.

Target nb of triangles of decimated mesh -

Max. nb of vertices / convex hull: -

Less 50 000 angles are recommended into one scene, otherwise the simulation will be heavy and slow.



Step 4

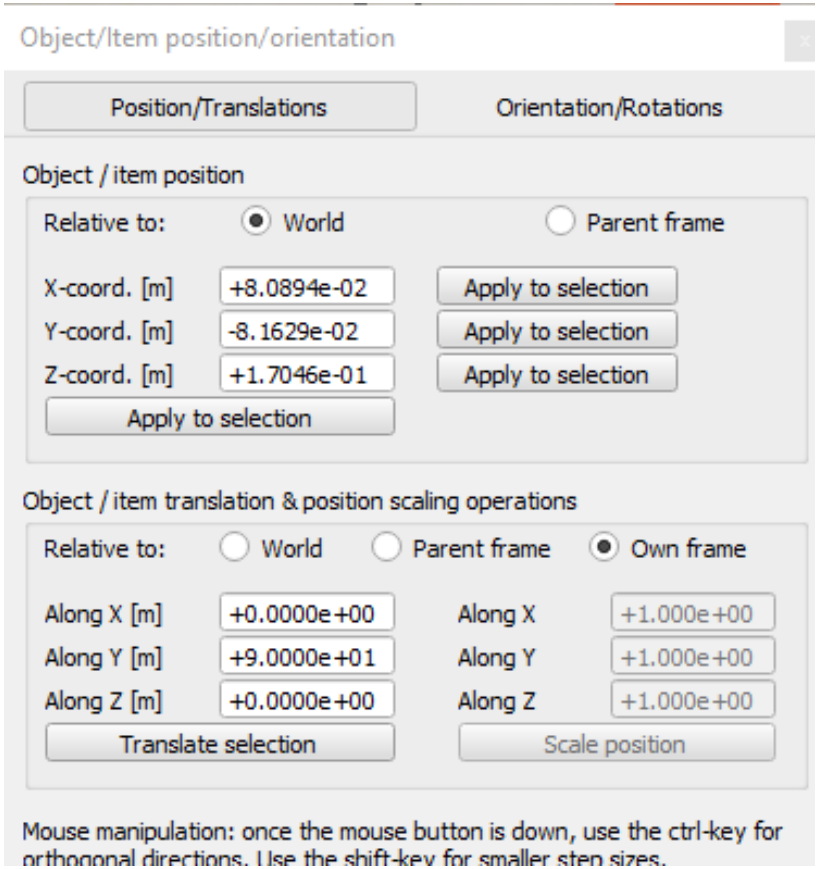
- Generate the elements of dynamics for each element of model.
- Also it is recommended to rename each generated element, set the same name like base element but appear "_dyn“ at the end.

How to add joints

- Execute the command "Add" -> "Joint" -> "Revolute".
- We have to set correct position for joints after added.
- It is recommended to copy all the elements of scene into a new scene, which we will use like some "draft".
- We have two ways t set positions: set coordinates relatively to our system and second way – apply(copy) positions from another components of system. For example, we can apply positions of our shaft for appropriate joint. For this on scene hierarchy select(by pressed ctrl+click) firstly the joint required to move and after that select shaft.

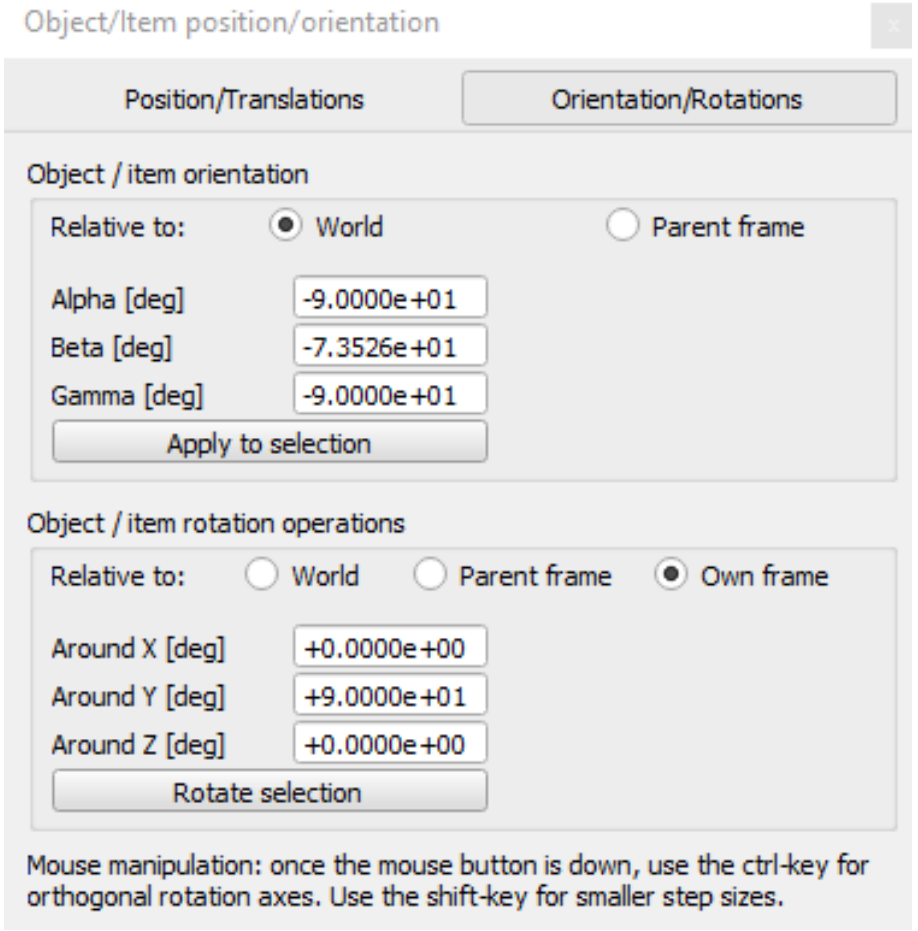
How to add joints

- After that click on «Object/Item shift» tool.
- In the arise dialog window click on «Apply to selection».



How to set orientations

- In the dialog window click on «Orientation/Rotations».
- After that, on bottom block select “Relative to:” «Own frame», set value and click «Rotate Selection».



Step 5

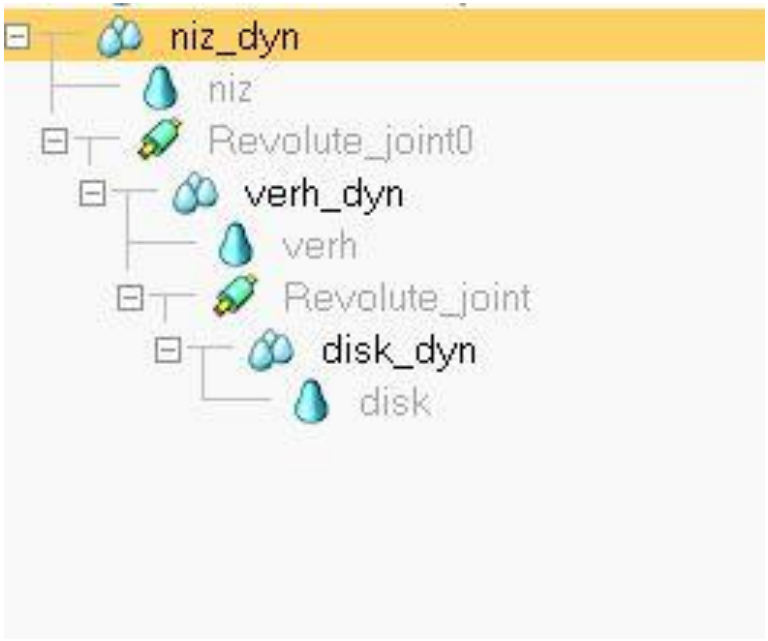
- Add joints and set correct positions using «draft scene».
- After that make copy of joints from «draft» scene to main scene.

How to assemble the components

We pointed positions of connection, but REP does not know which components have to be connected, i.e. it is necessary to specify the mechanical structure.

- In the scene hierarchy you must associate the items which have to be connected.
- One of the elements must be base.
- The joint have to be attached to it.
- Associate two elements with the dynamics is not allowd without joint between them.
- Design elements (just form) may not participate in the serial chain, and only the "leaf" in the structure tree.

Example of model structure



Step 6

Make it in «Scene hierarchy»:

- Determine for yourself the base element (dyn).
- Associate “daughter-components” to joints.
- And the joints to “parent-components” (dyn).

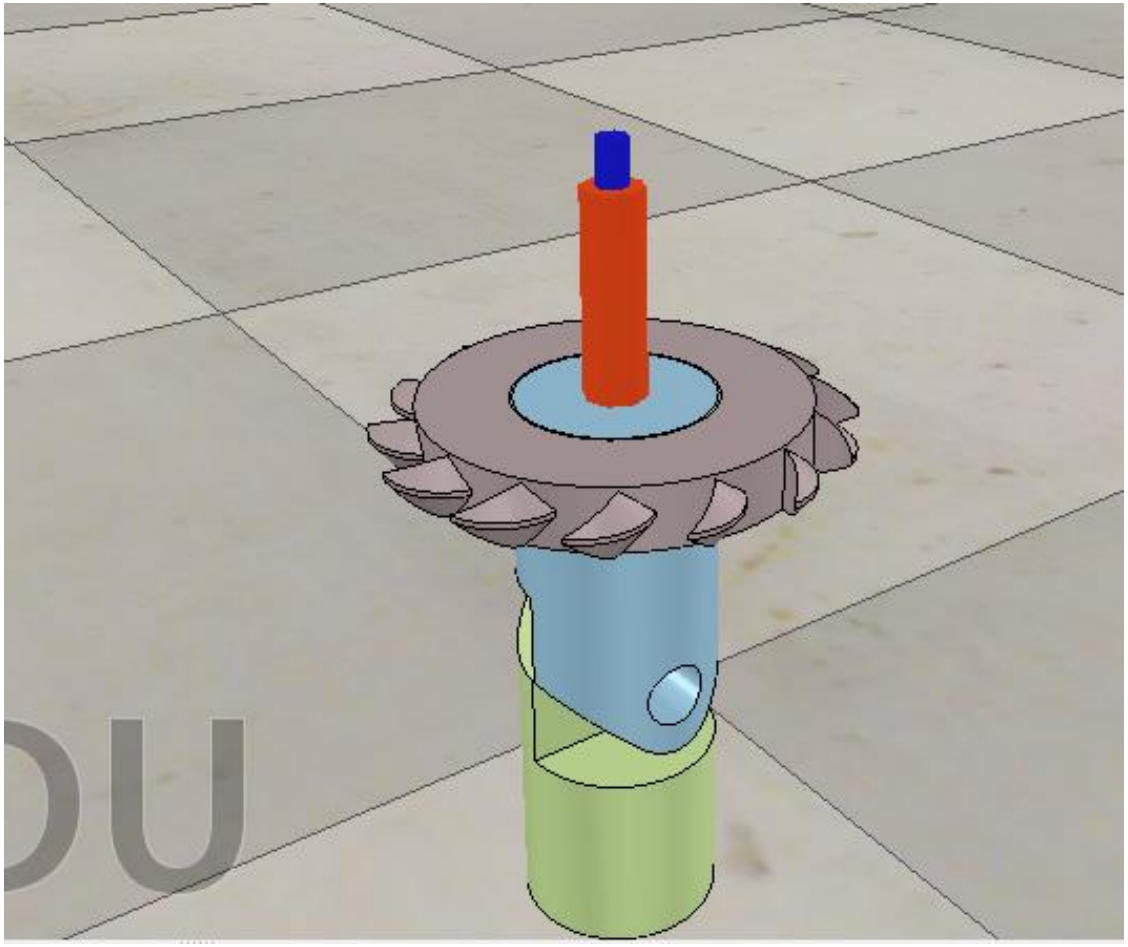
Grouping and Merging of dynamic elements

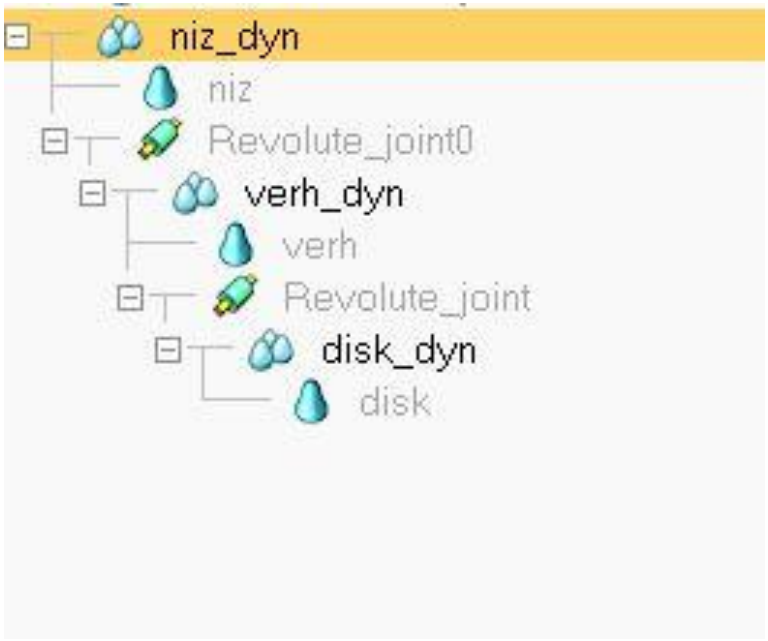
- There are opportunities for Merging of convex shapes using commands «Edit» -> «Grouping/Merging» -> «appropriate command».
- Also we can group several shapes using commands «Edit» -> «Grouping/Merging» -> «appropriate command».

Step 7

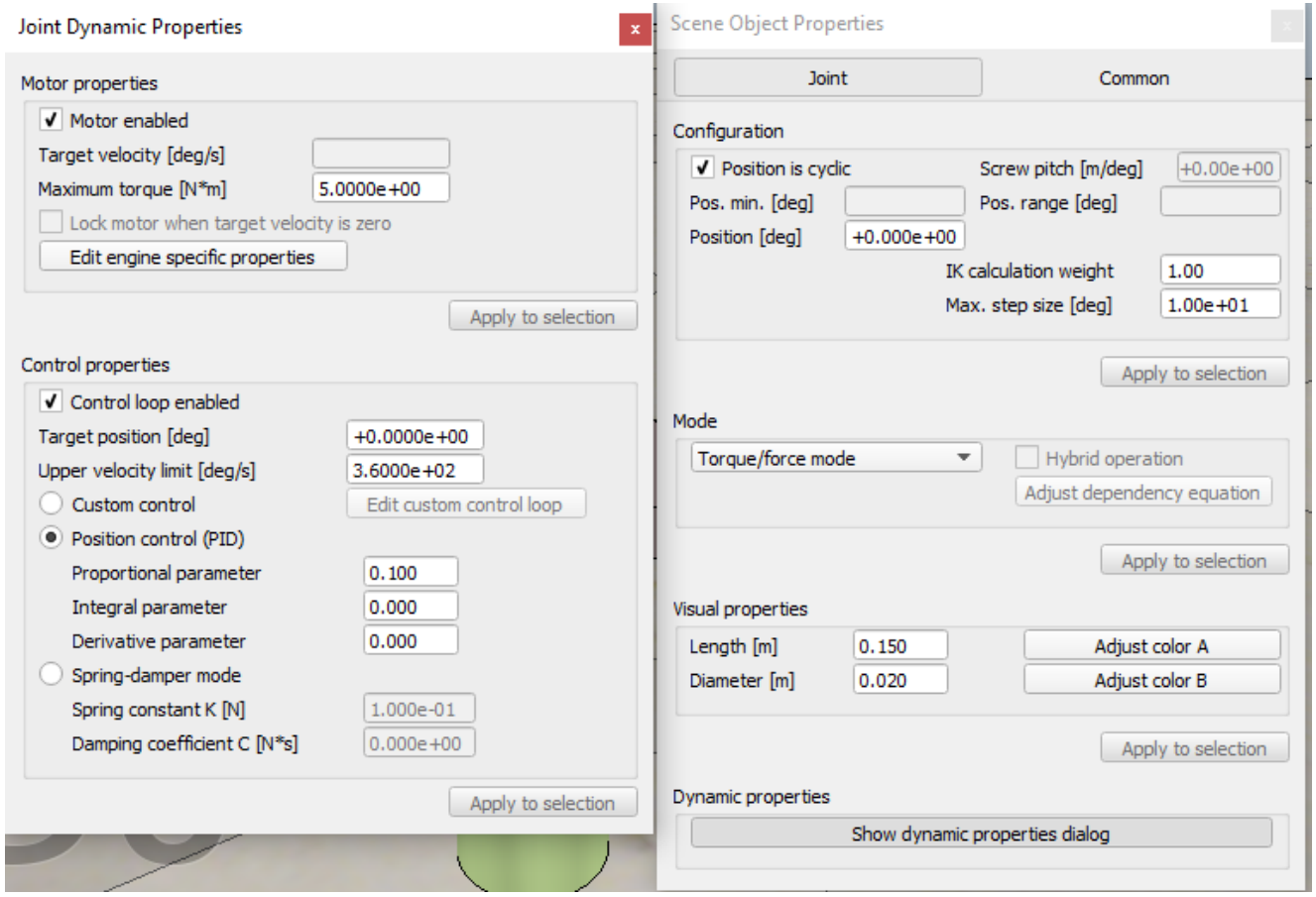
We have set parameters for dynamic elements also, i.e. set dynamic properties.

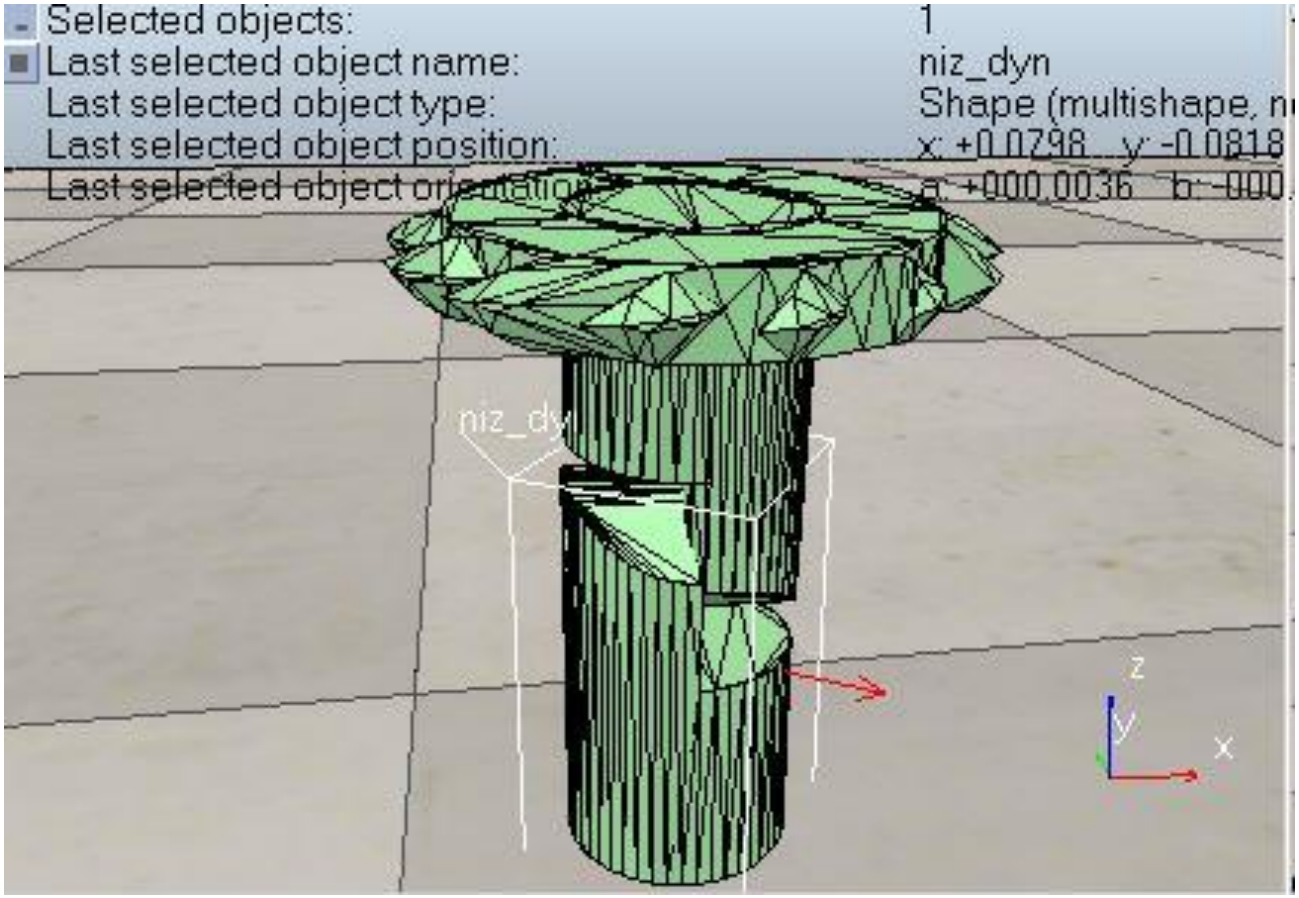
- Open «Properties» -> «Show dynamic properties» for base element set «body is respondable», also set «local mask» 0000 1111.
- On next dynamic element set mask 1111 0000 and tick «body is dynamic» (also required to click «compute mass and inertia»).




niz_dyn
niz
Revolute_joint0
verh_dyn
verh
Revolute_joint
disk_dyn
disk

Joint motor


Joint Dynamic Properties
Motor properties
Motor enabled
Target velocity [deg/s]
Maximum torque [N*m]
5.0000e+00
Lock motor when target velocity is zero
Edit engine specific properties
Apply to selection
Control properties
Control loop enabled
Target position [deg]
+0.0000e+00
Upper velocity limit [deg/s]
3.6000e+02
Custom control
Edit custom control loop
Position control (PID)
Proportional parameter
0.100
Integral parameter
0.000
Derivative parameter
0.000
Spring-damper mode
Spring constant K [N]
1.000e-01
Damping coefficient C [N*s]
0.000e+00
Apply to selection
Scene Object Properties
Joint
Common
Configuration
Position is cyclic
Screw pitch [m/deg]
+0.00e+00
Pos. min. [deg]
Pos. range [deg]
Position [deg]
+0.000e+00
IK calculation weight
1.00
Max. step size [deg]
1.00e+01
Apply to selection
Mode
Torque/force mode
Hybrid operation
Adjust dependency equation
Apply to selection
Visual properties
Length [m]
0.150
Adjust color A
Diameter [m]
0.020
Adjust color B
Apply to selection
Dynamic properties
Show dynamic properties dialog


Selected objects:
1
Last selected object name:
niz_dyn
Last selected object type:
Shape (multishape, n
Last selected object position:
x: +0.0798 y: -0.0818
Last selected object orientation:
a: +000.0036 b: -000
niz_dyn
z
y
x

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Thank you for attention!

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