NAAC GRADE A+
Accredited University

CU CHANDIGARH UNIVERSITY

Introduction to Robotics and

CoppeliaSim
from the creators of V-REP

Dr. Prashant Upadhyaya

Senior Member-IEEE, Fellow-IETE-Australia, IETE (M)-India

Associate Professor, ECE (AU-1)

Chandigarh University

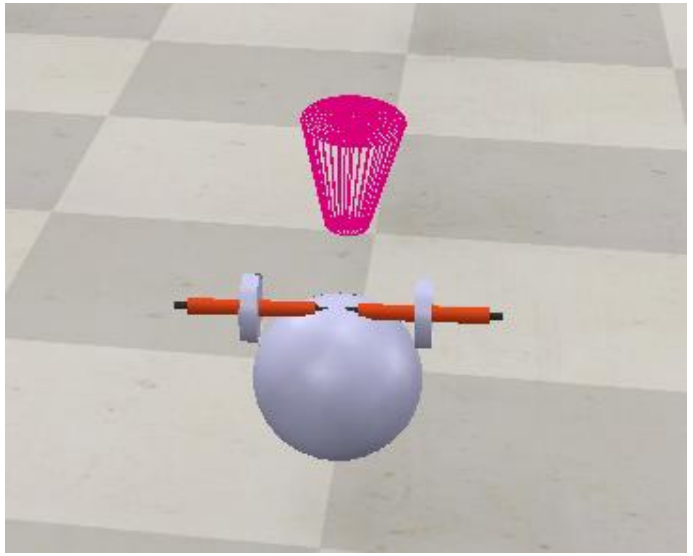
Research Profile -Dr. Prashant Upadhyaya - Google Scholar

Creating stable: BubbleRob

We run the simulation and notice that the robot is falling backwards.

We are still missing a third contact point to the floor.

We now add a small slider (or caster).

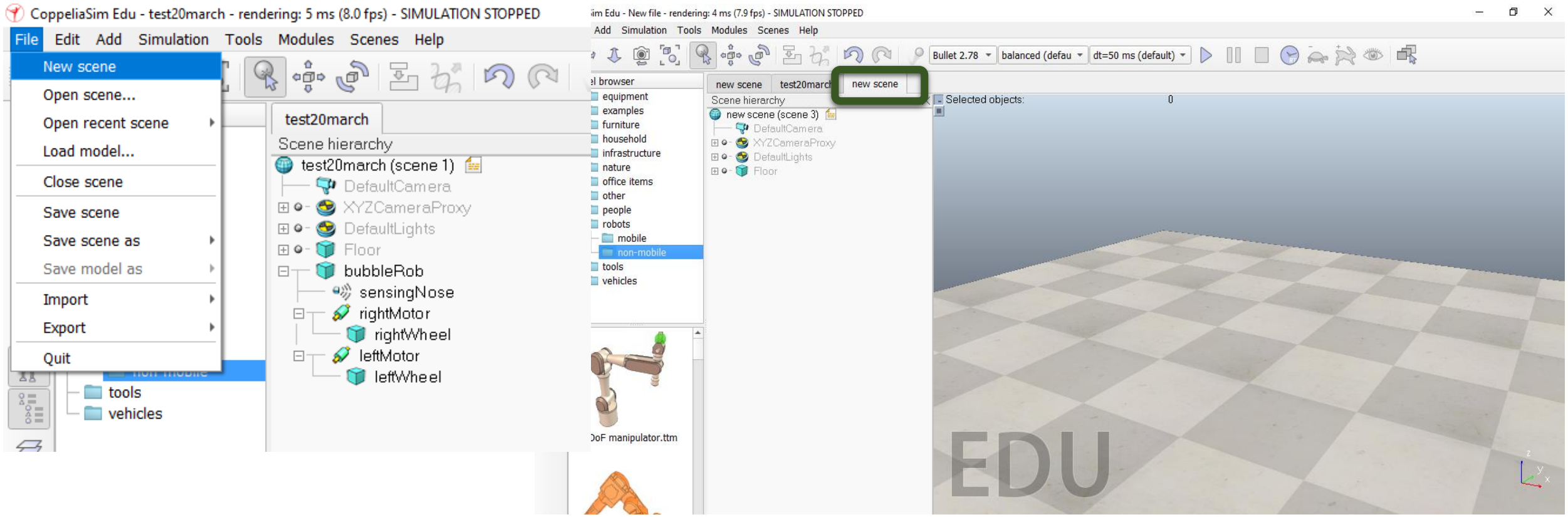


STEP 17

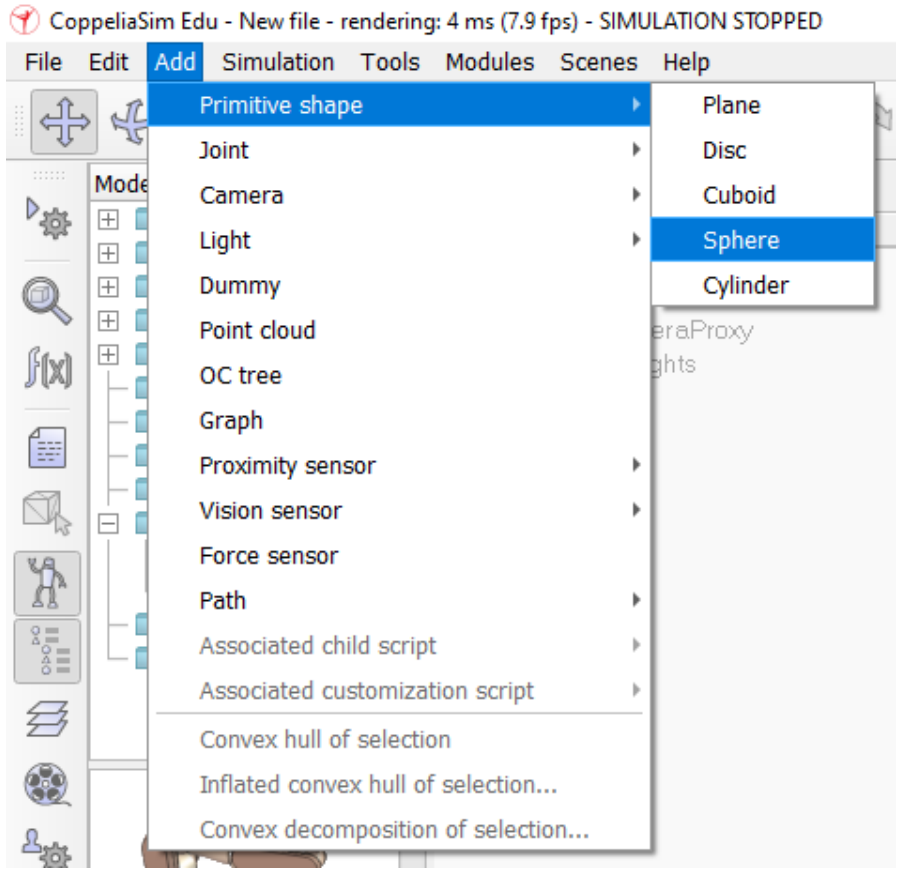
We will design small slider (or caster).

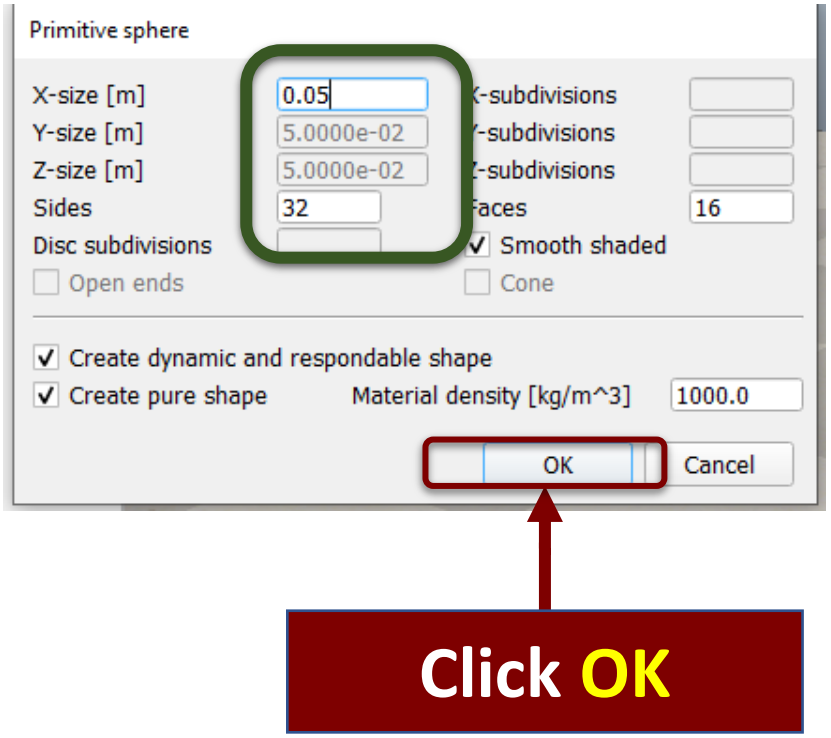
We create a new scene with

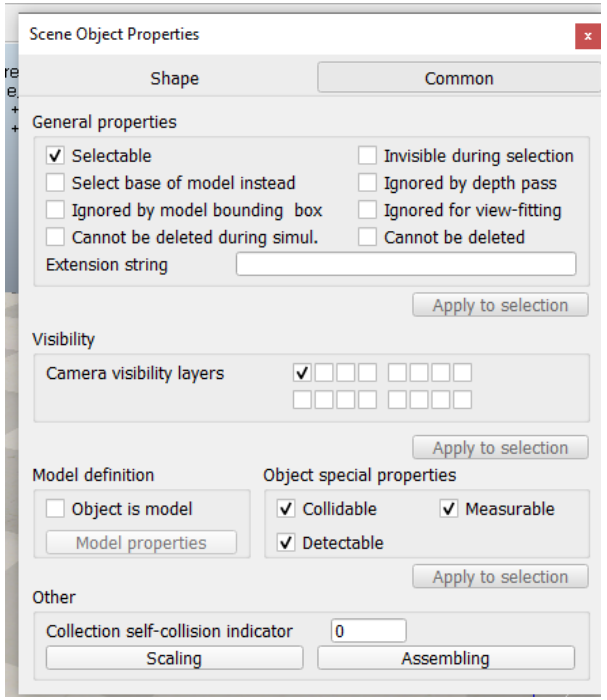
[Menu bar --> File --> New scene]



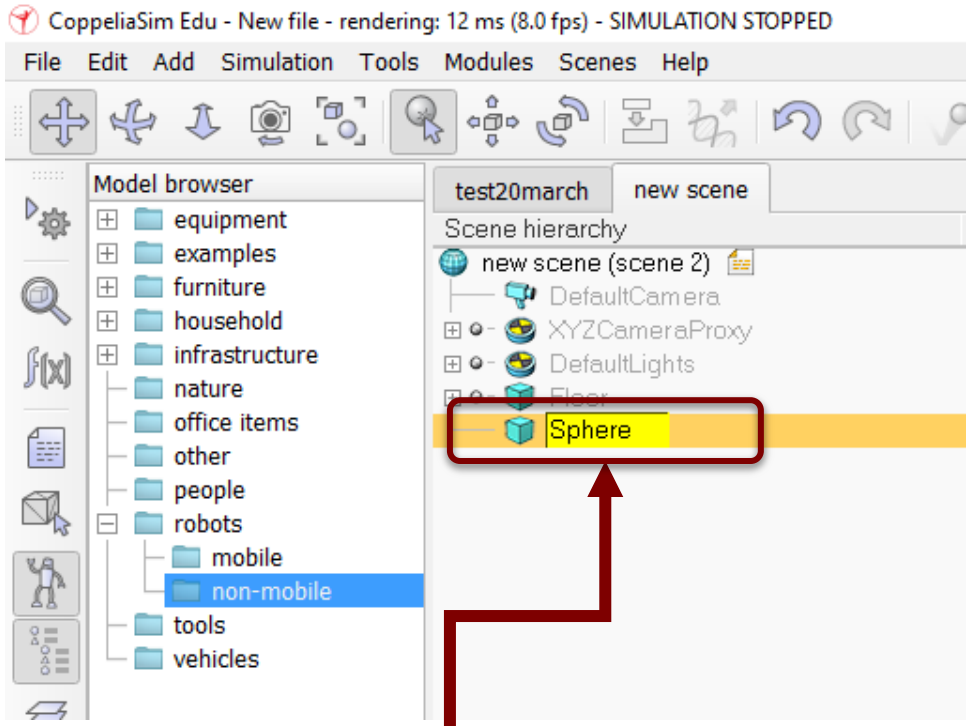
Add a pure primitive sphere with diameter 0.05 and make the sphere Collidable, Measurable and Detectable (if not already enabled)

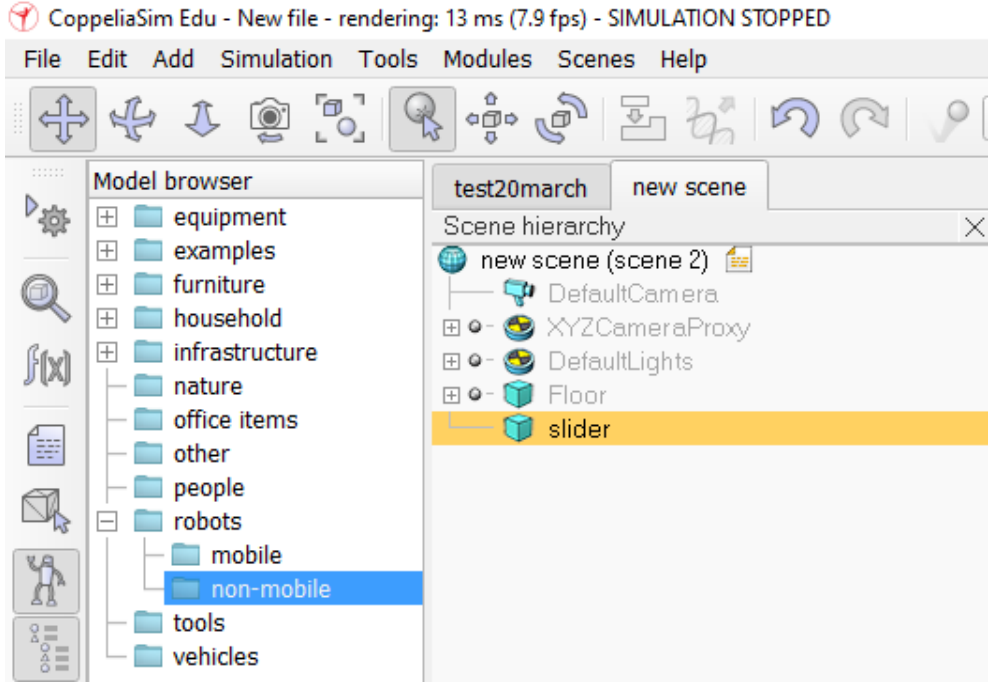






Rename it to slider

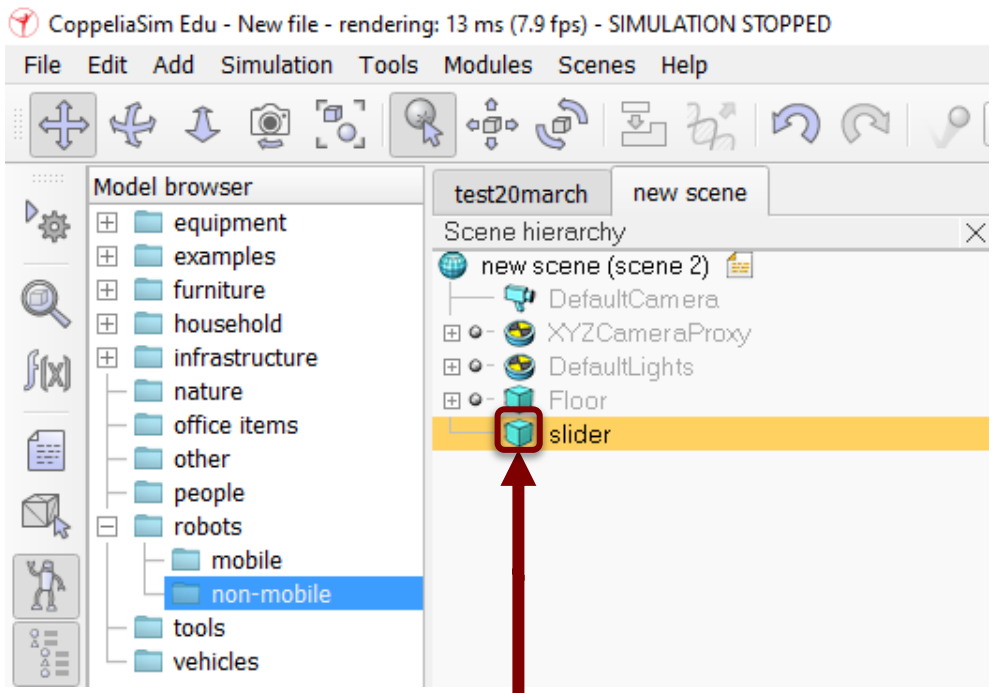




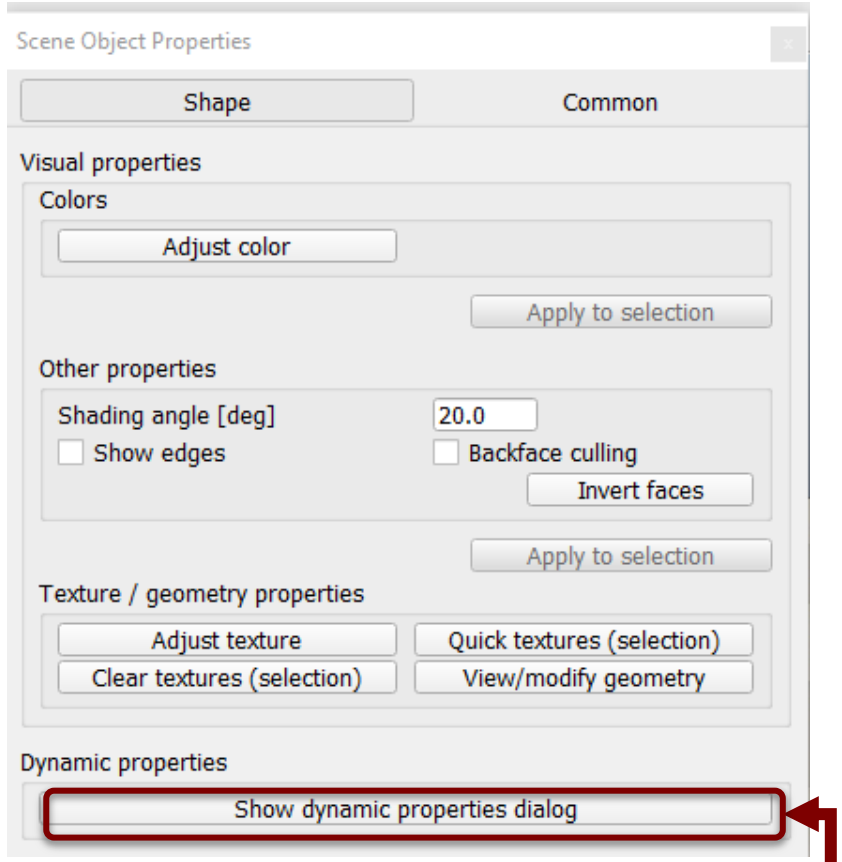
Double Click on this and rename it to slider and Press ENTER

STEP 18

We set the Material to noFrictionMaterial in the shape dynamics properties.

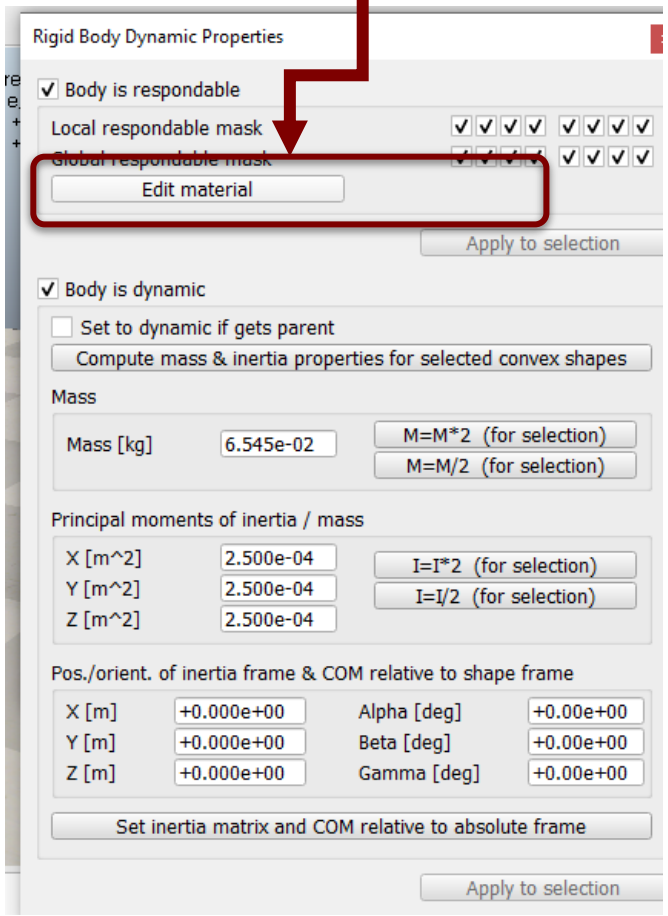


Double Click on teal colour shape



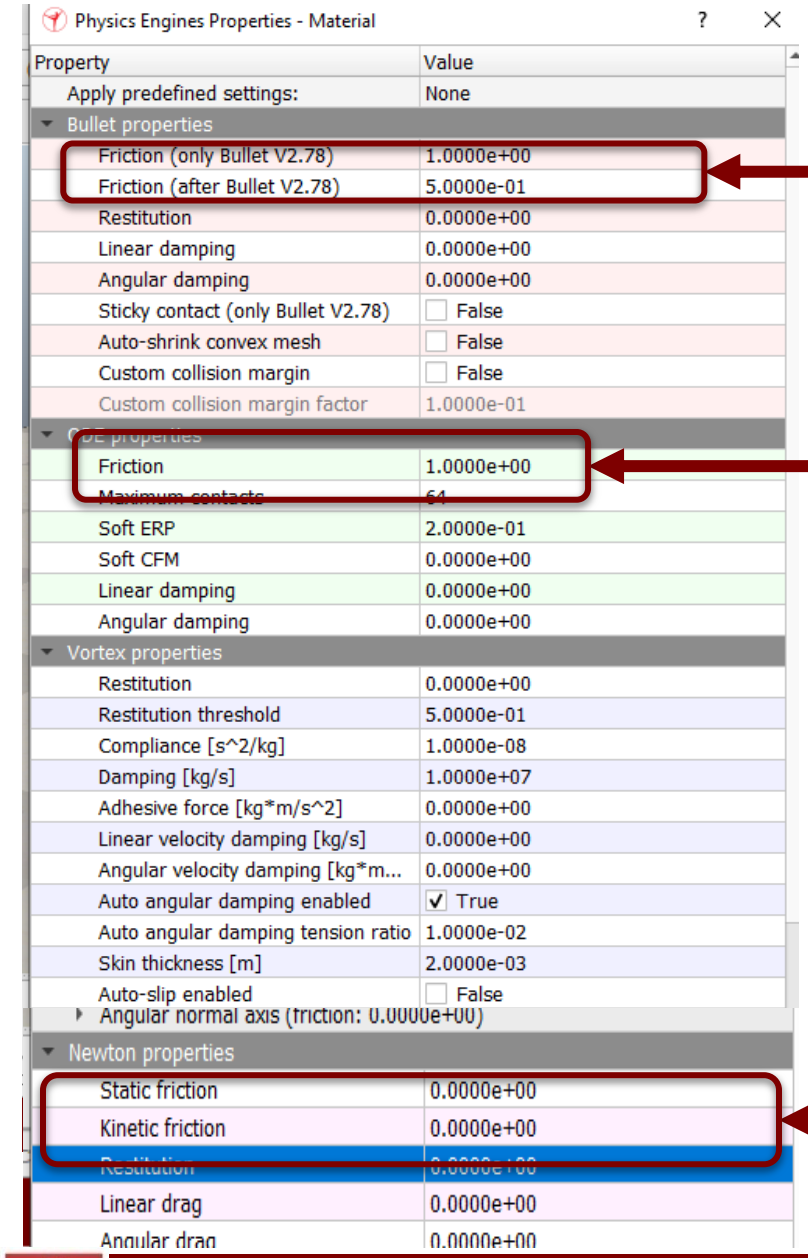
Click on this

Click on this



Put value zero(0) where ever you find term

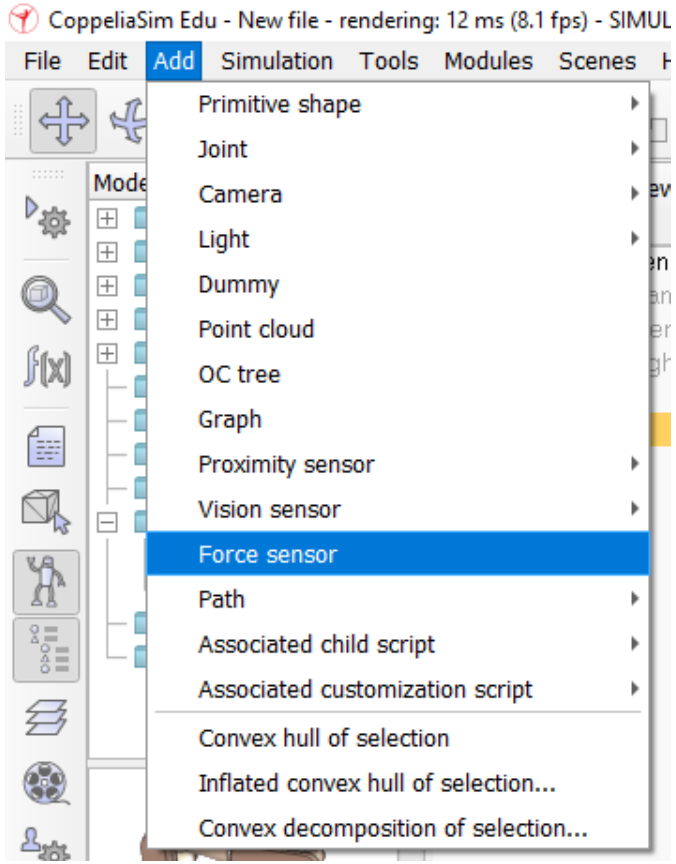
Friction in Properties Material

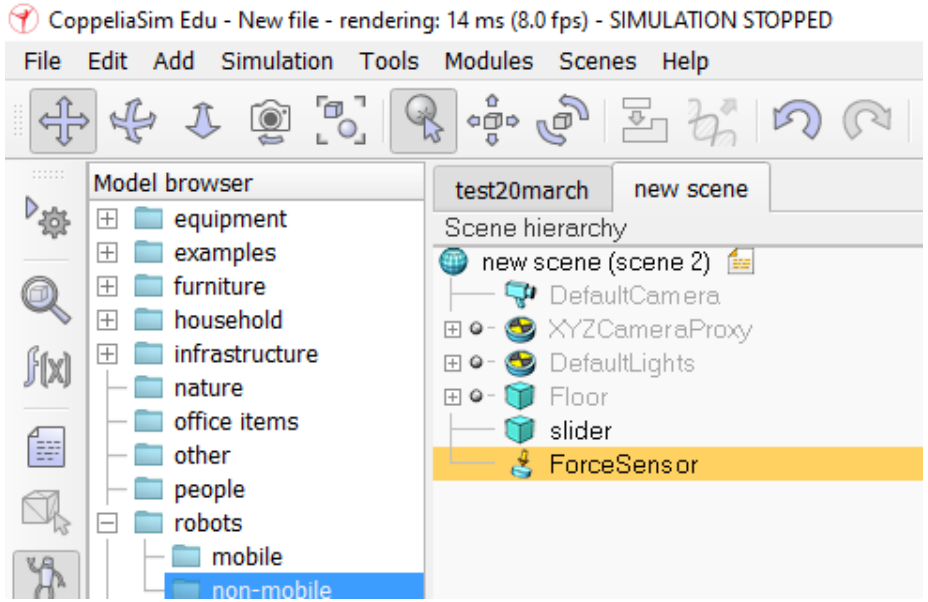


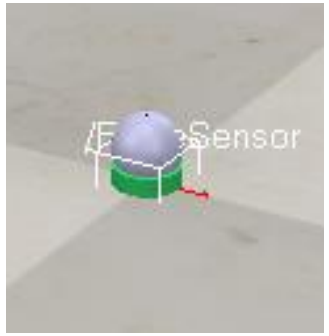
Make it zero

STEP 19

To rigidly link the slider with the rest of the robot, we add a force sensor object with [Menu bar --> Add --> Force sensor]

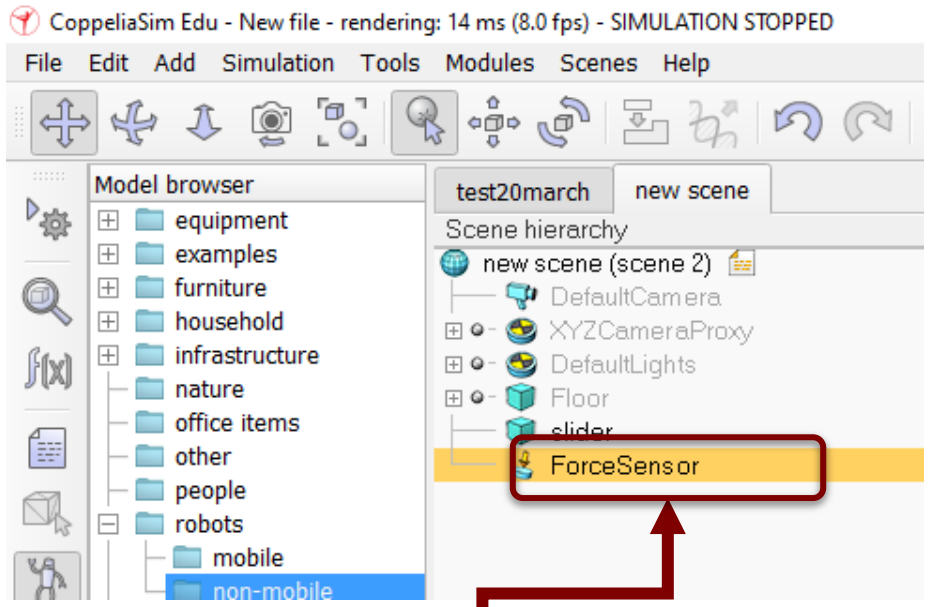


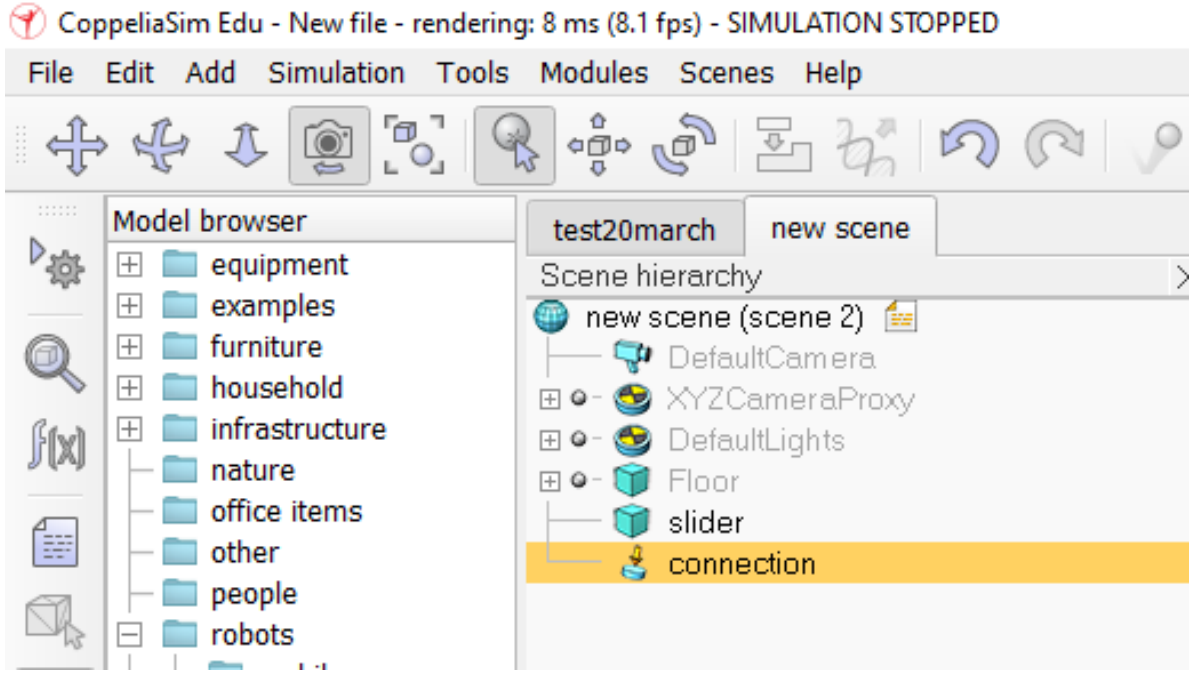




STEP 20

We rename it to connection and shift it up by 0.05

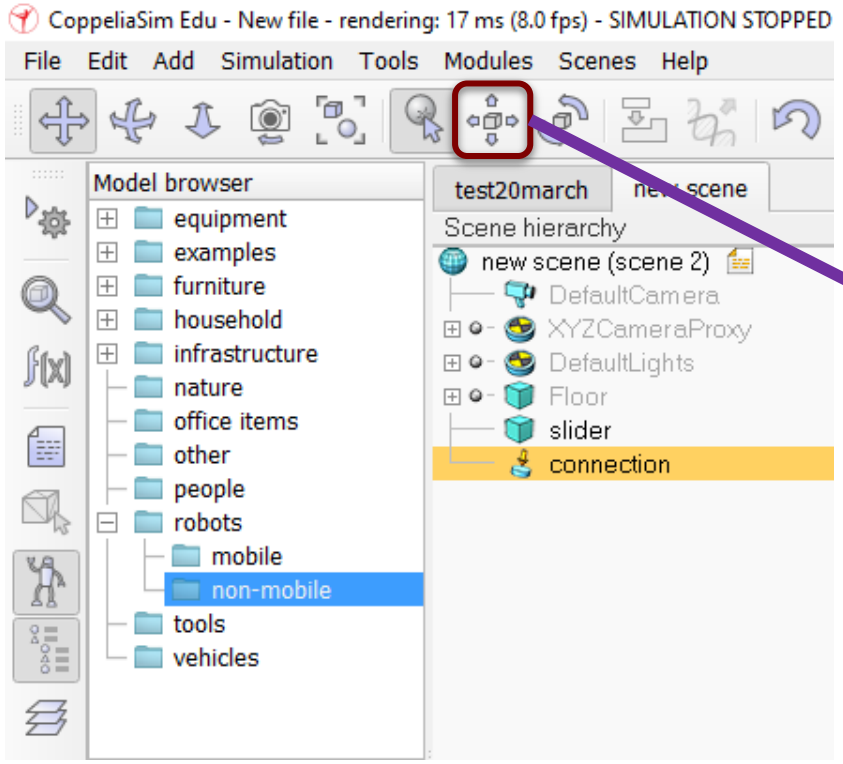


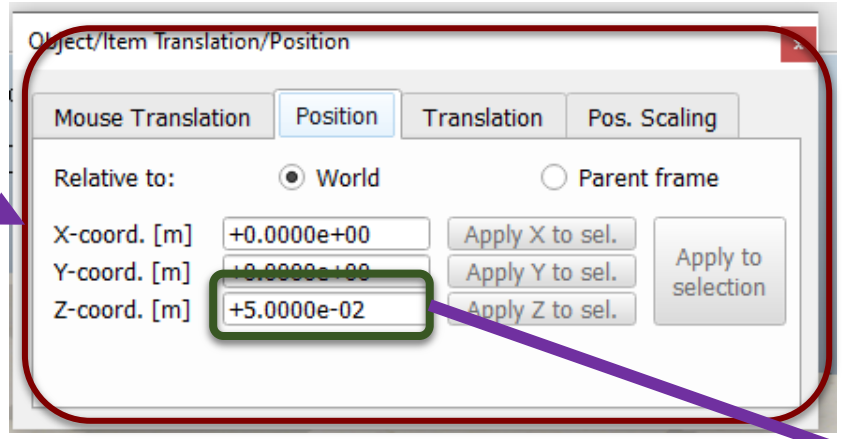


Double Click on this and rename it to connection and Press ENTER

Shift it up by 0.05

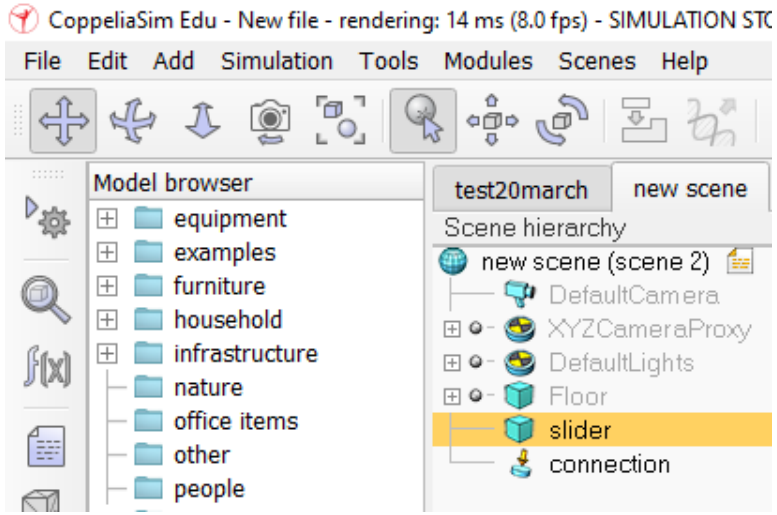
(Open position dialogue and put 0.05 in z-axis)

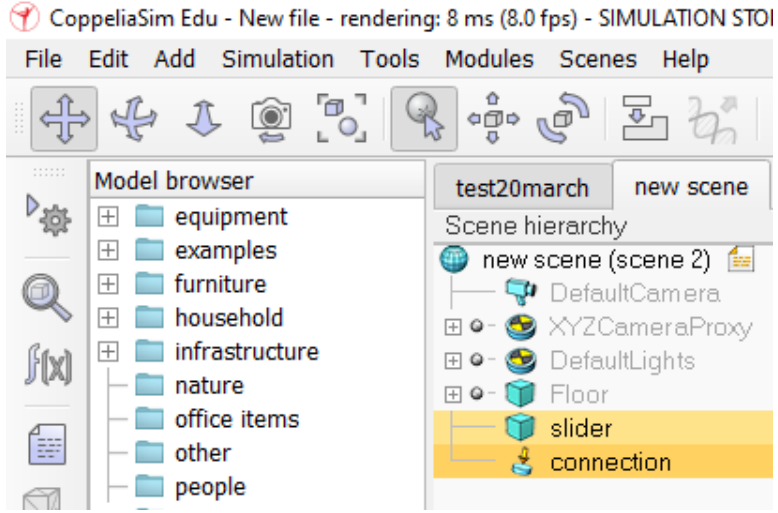


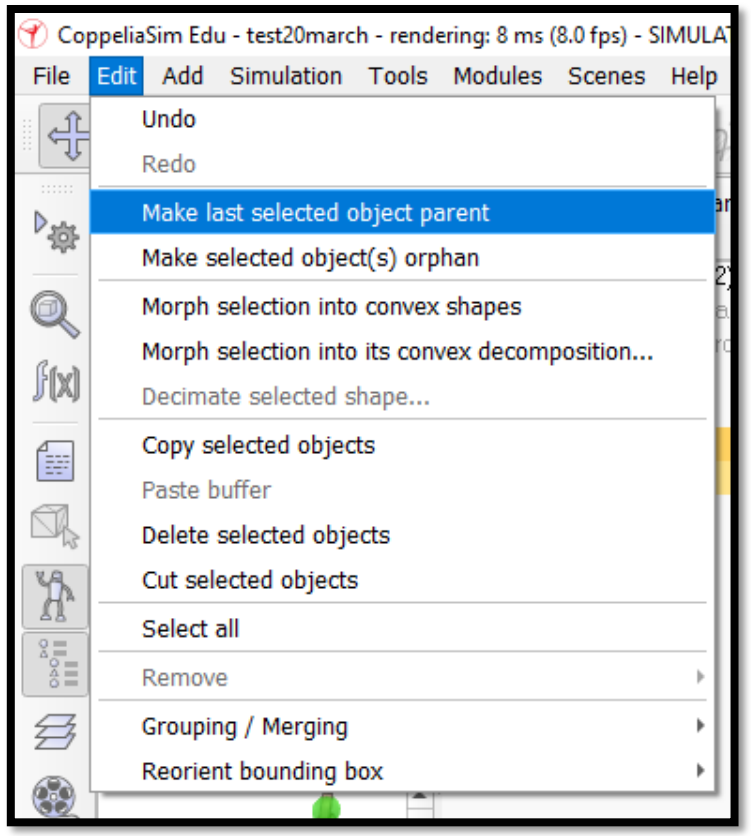


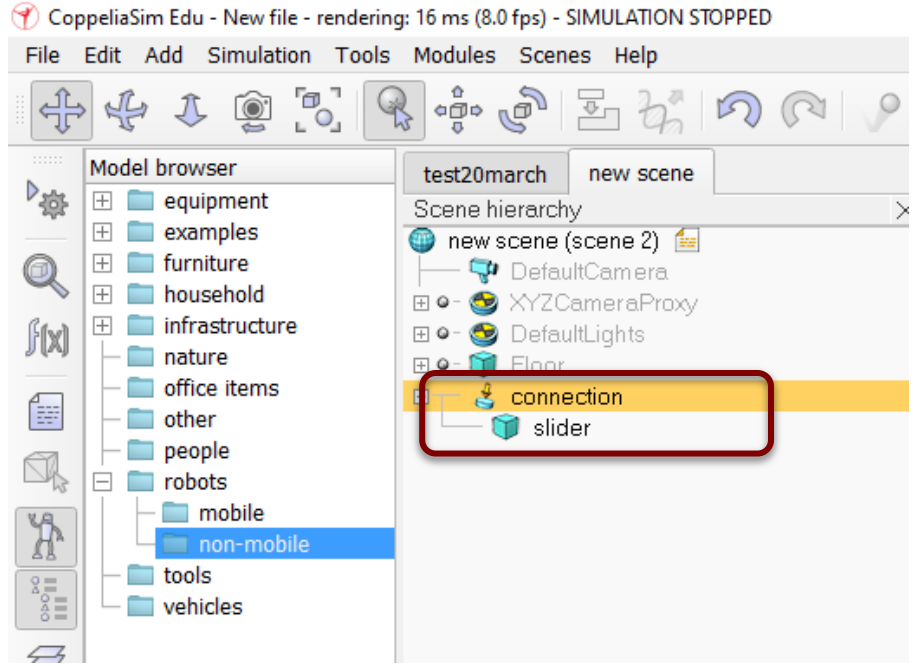
We attach the slider to the force sensor, then copy both objects, switch back to scene 1 and paste them.

We select slider, then control-select connection, then click [Menu bar --> Edit --> Make last selected object parent].

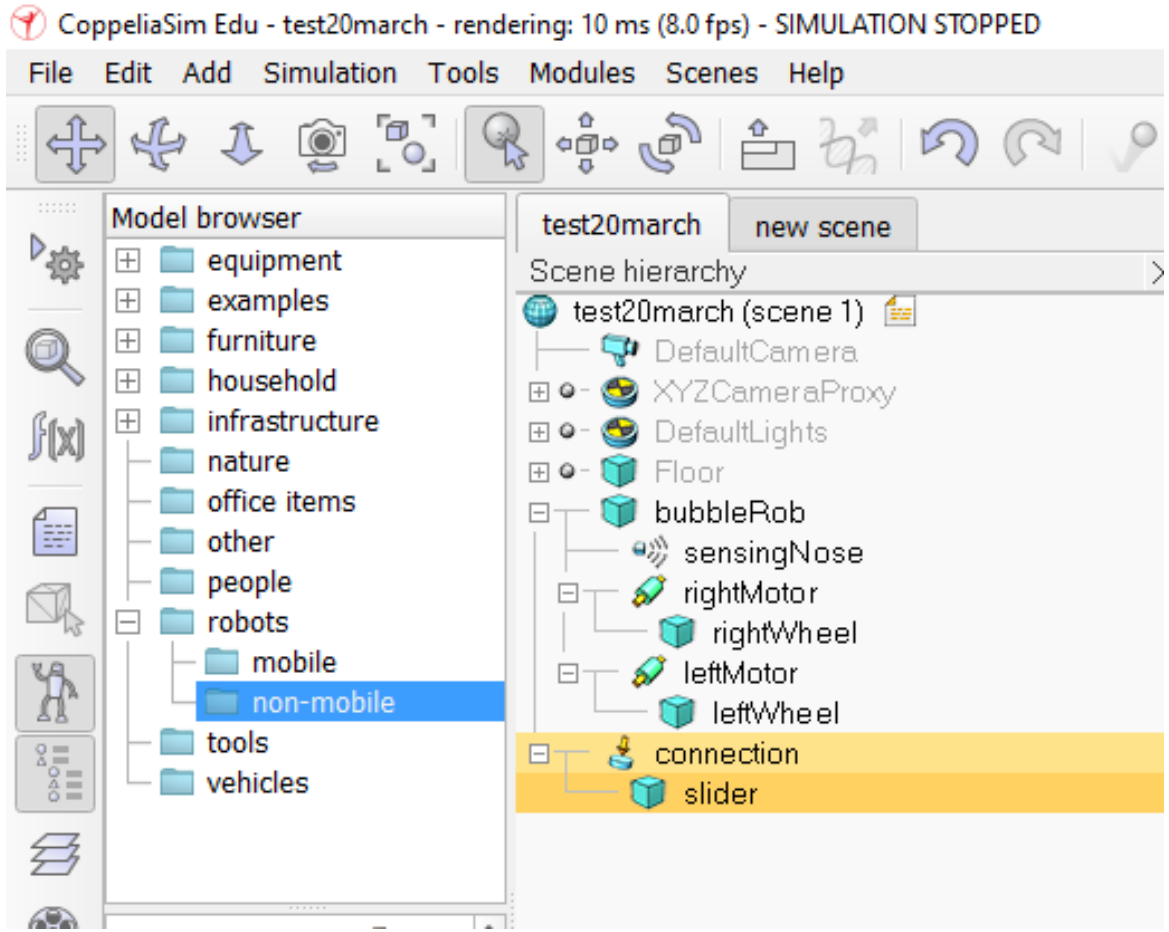


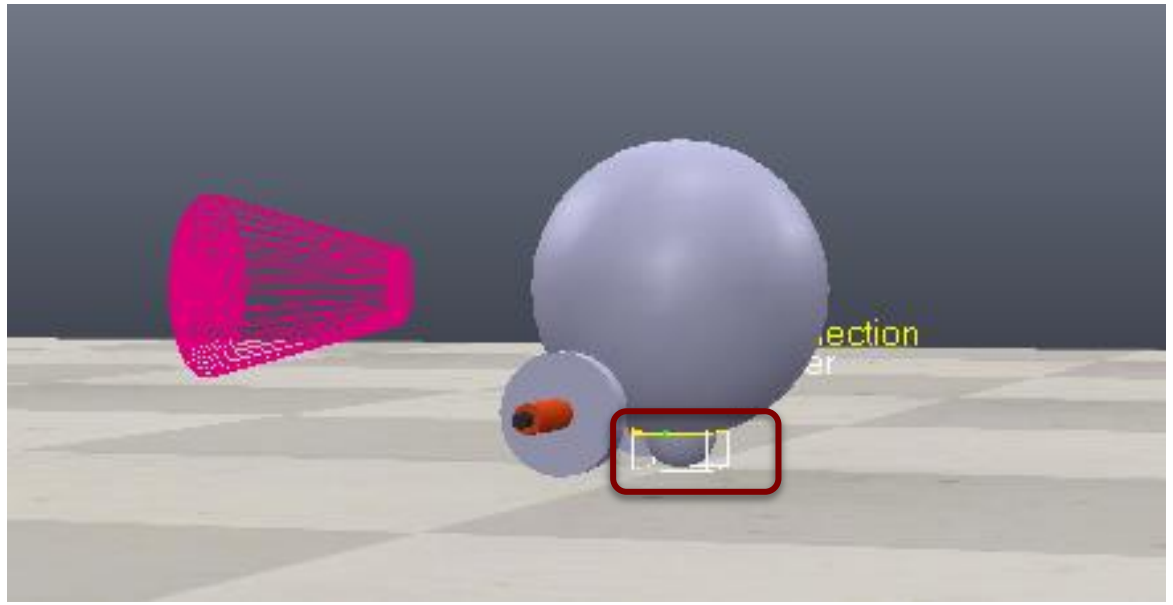






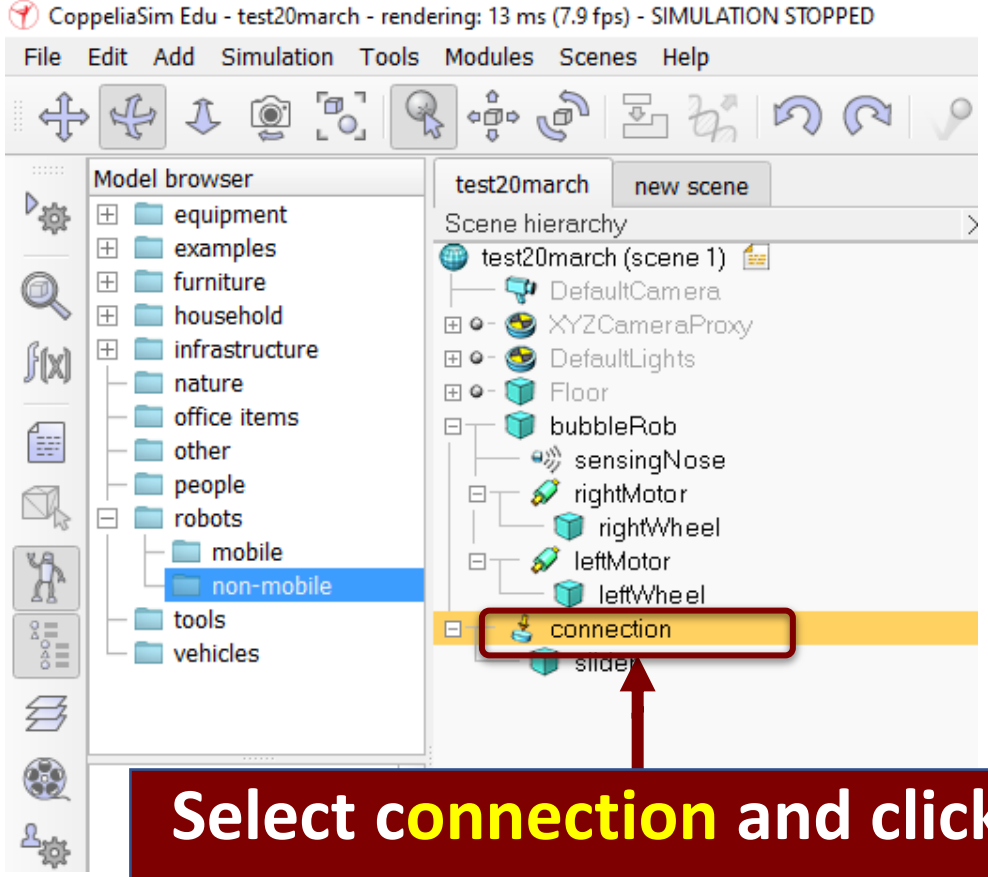
Switch back to scene 1 and paste them

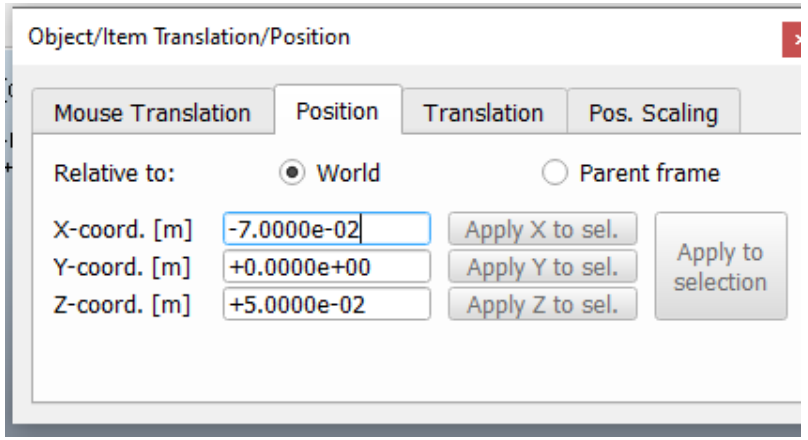




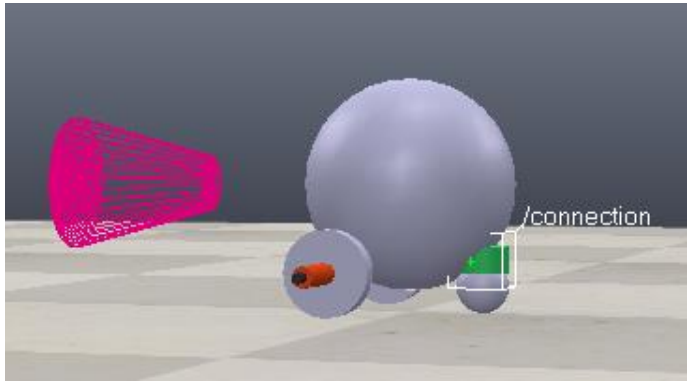
STEP 21

Shift the force sensor by -0.07 along the absolute X-axis, then attach it to the robot body.

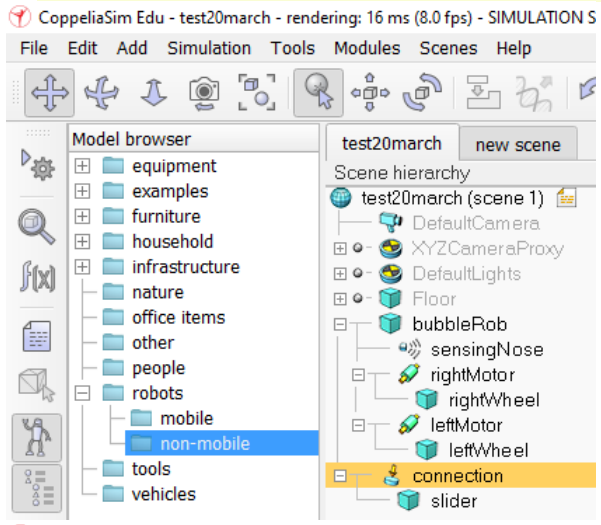


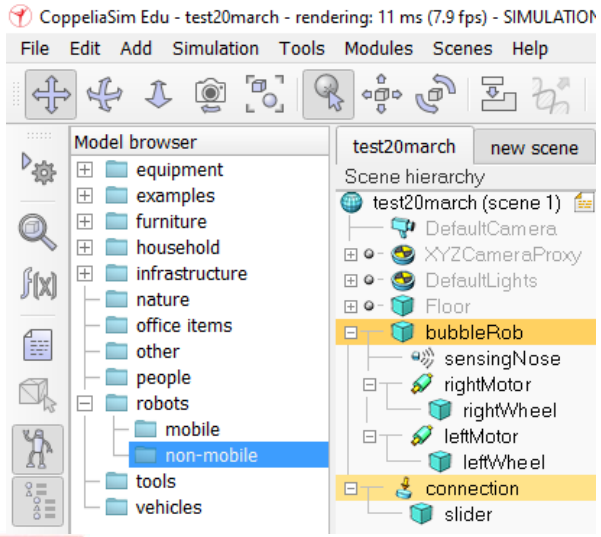


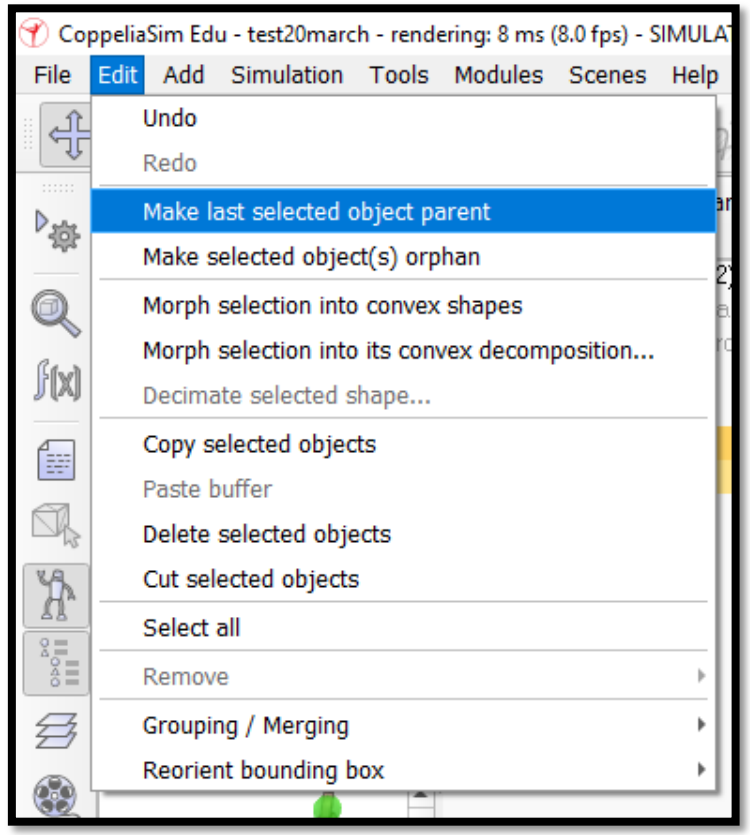
Select connection and click on Position dialogue

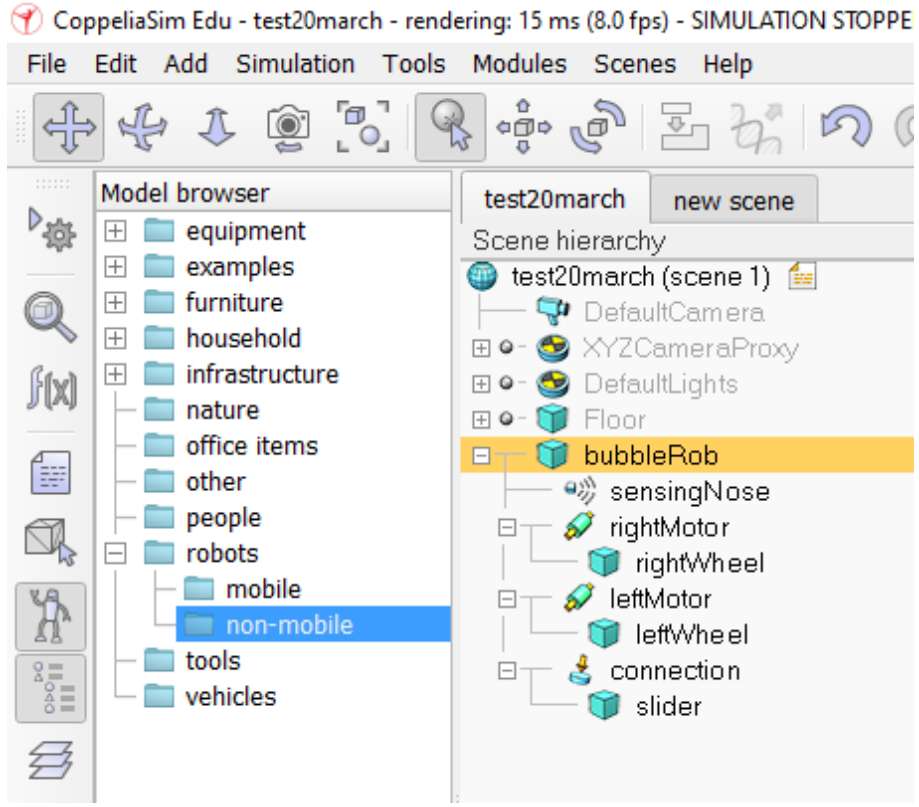


We select connection, then control-select bubbleRob, then click [Menu bar --> Edit --> Make last selected object parent].









If we run the simulation now, we can notice that the slider is slightly moving in relation to the robot body:

this is because both objects (i.e. slider and bubbleRob) are colliding with each other.

To avoid strange effects during dynamics simulation, we have to inform CoppeliaSim that both objects do not mutually collide, and we do this in following way:

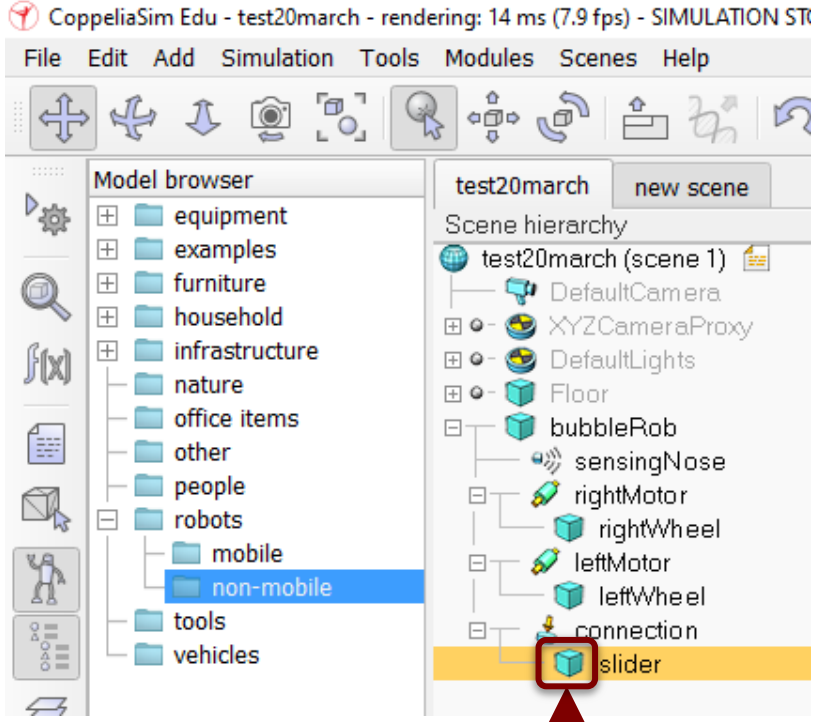
in the shape dynamics properties,

for slider we set the local respondable mask to 00001111, and

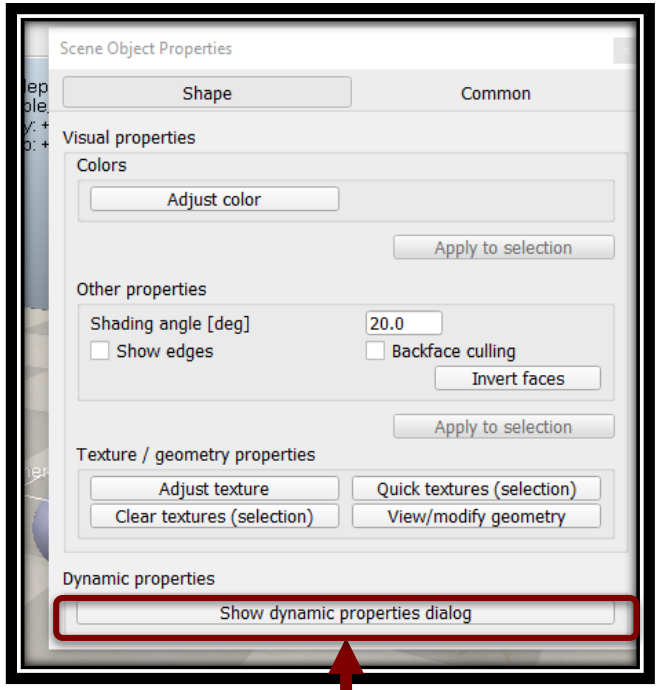
for bubbleRob, we set the local respondable mask to 11110000.

STEP 22

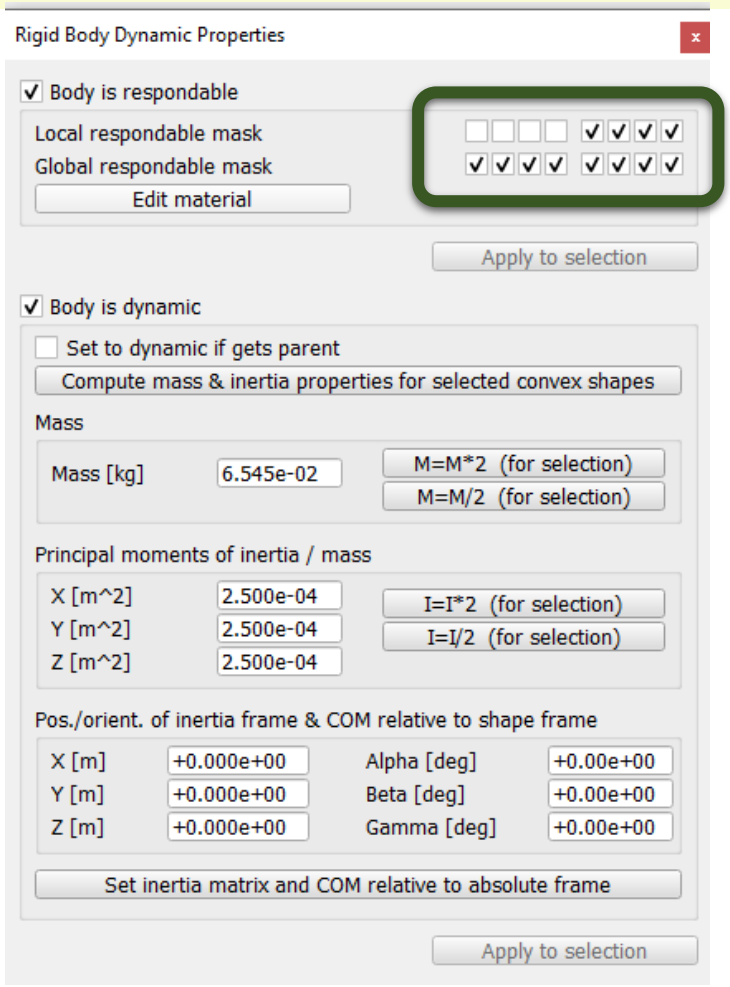
For slider we set the local respondable mask to 00001111,



Double Click on teal colour shape

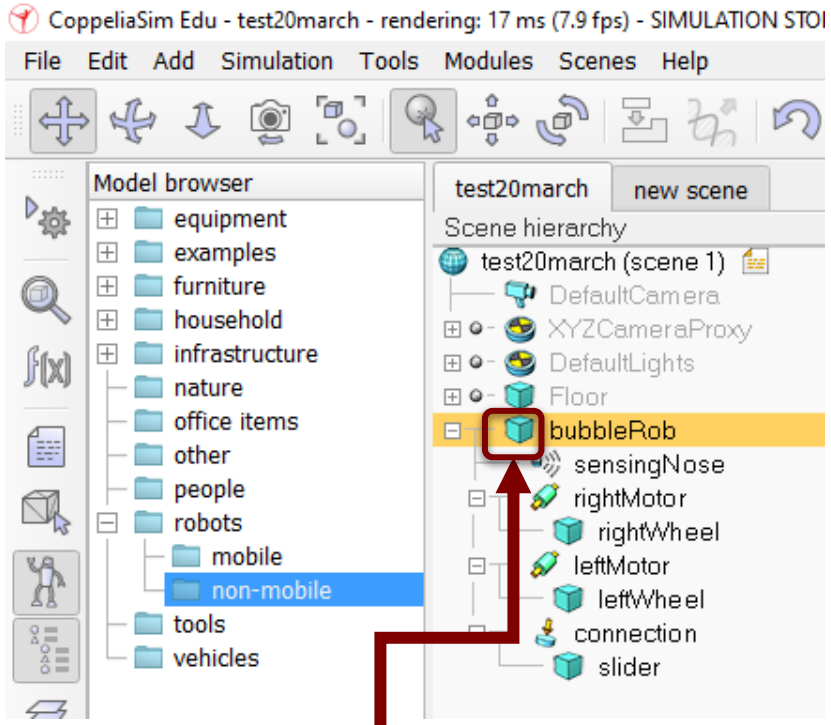


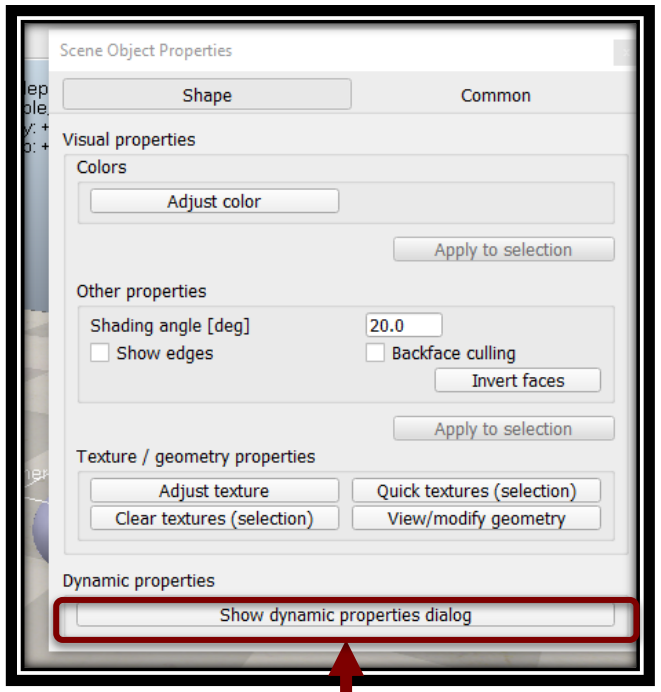
Click on this

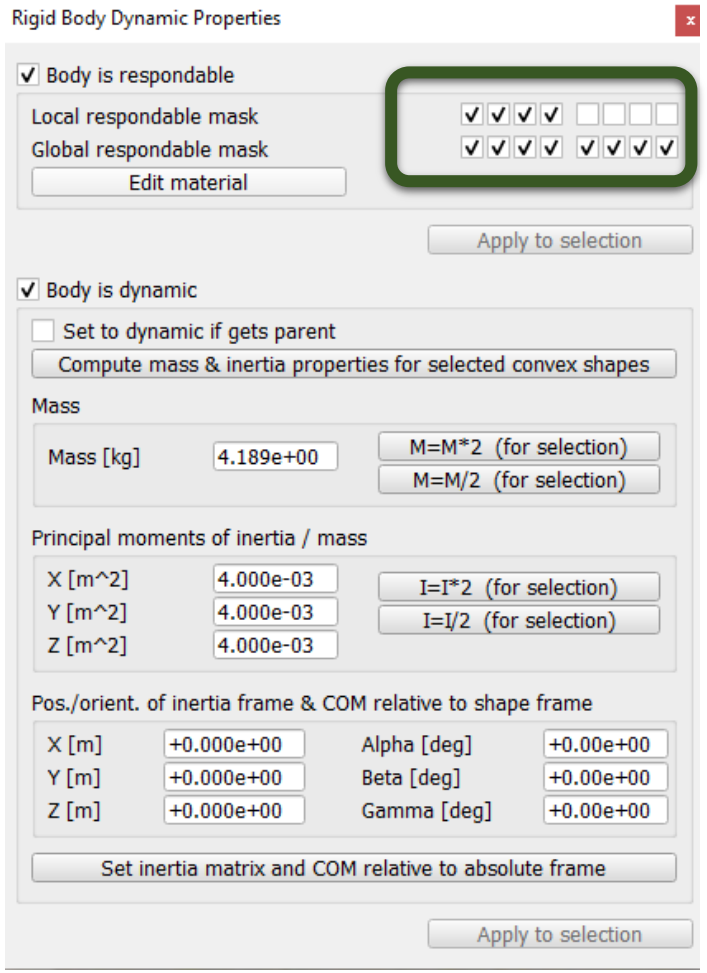


STEP 23

For bubbleRob, we set the local respondable mask to 11110000







Double Click on teal colour shape

Click on this

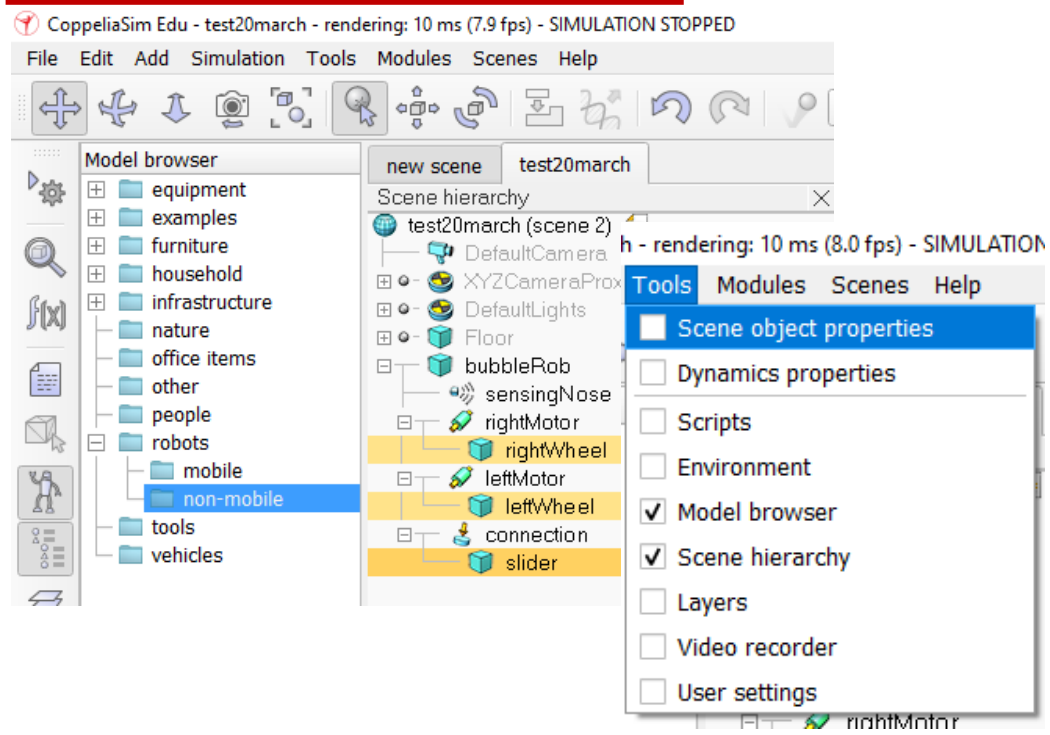
We run the simulation again and notice that BubbleRob slightly moves, even with locked motor.

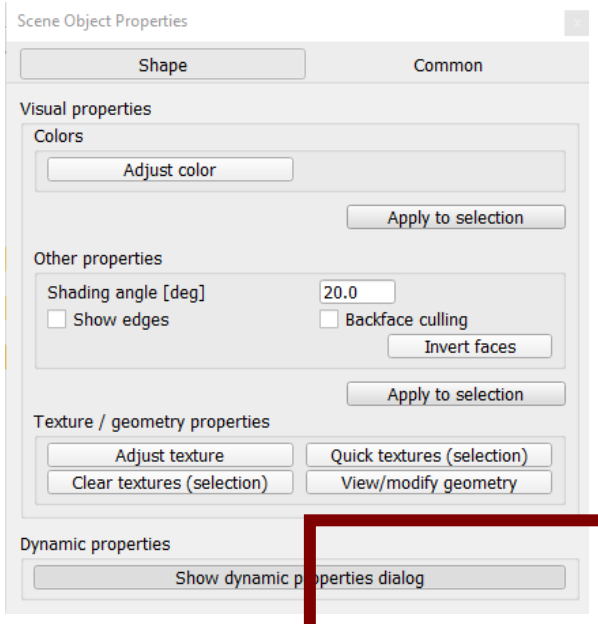
Stability of dynamic simulations is tightly linked to masses and inertias of the involved non-static shapes.

We now try to *correct for that undesired effect*.
We select the two wheels and the slider, and in the *shape dynamics dialog we click three times M=M*2 (for selection)*.

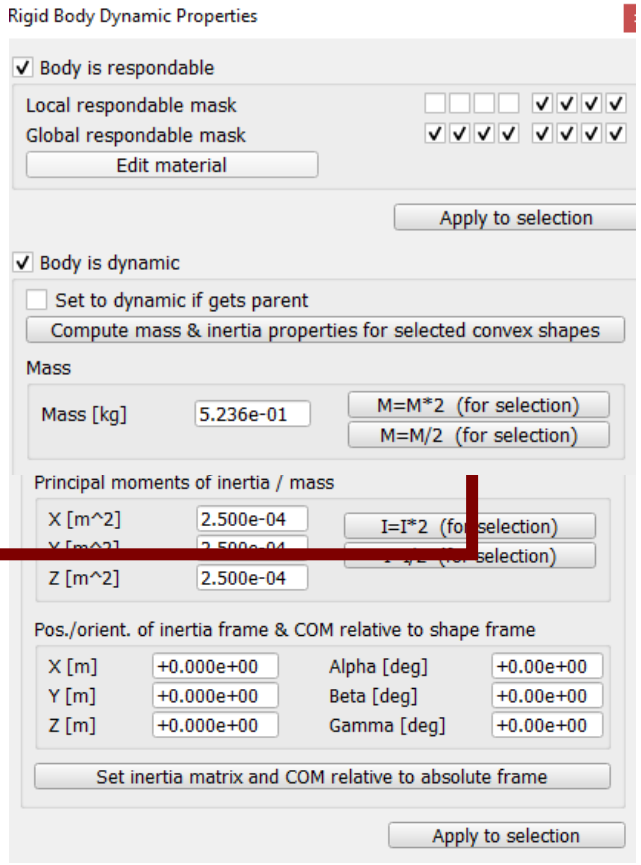
STEP 24

Select the two wheels and the slider, and in the shape dynamics dialog we click three times M=M*2 (for selection).



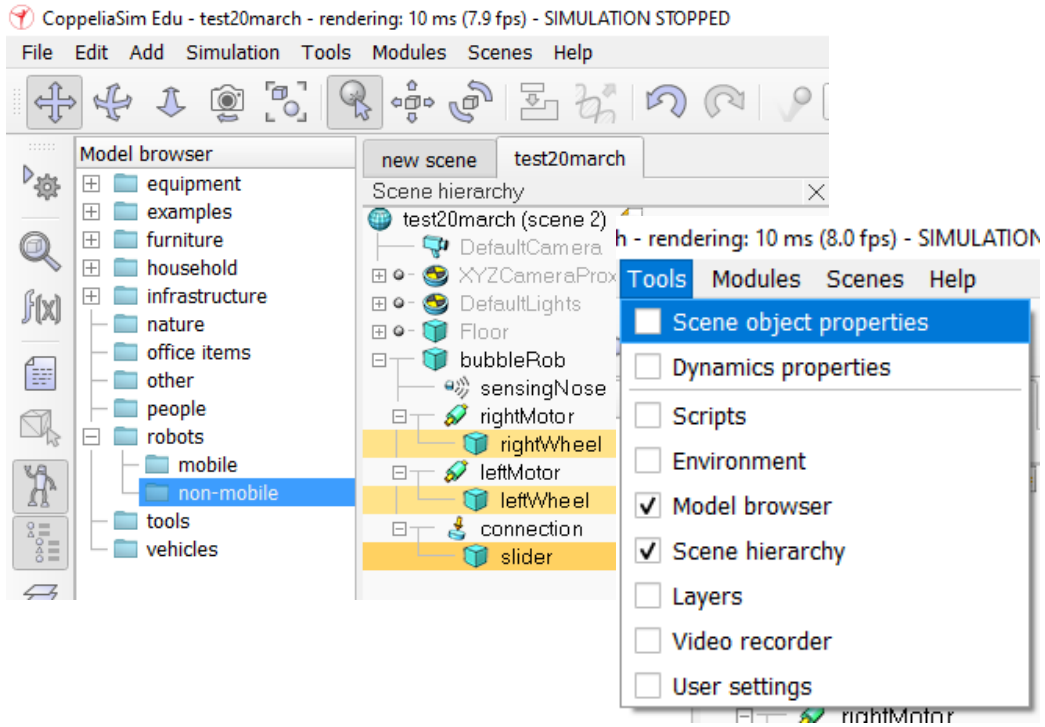


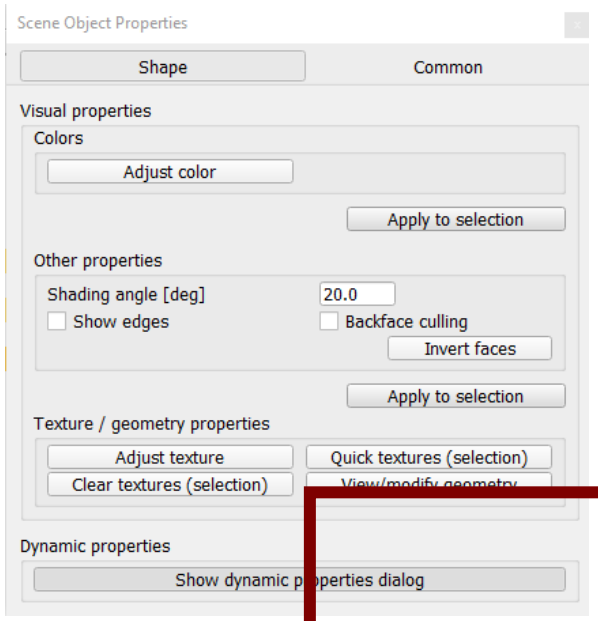
Click on this 3 times



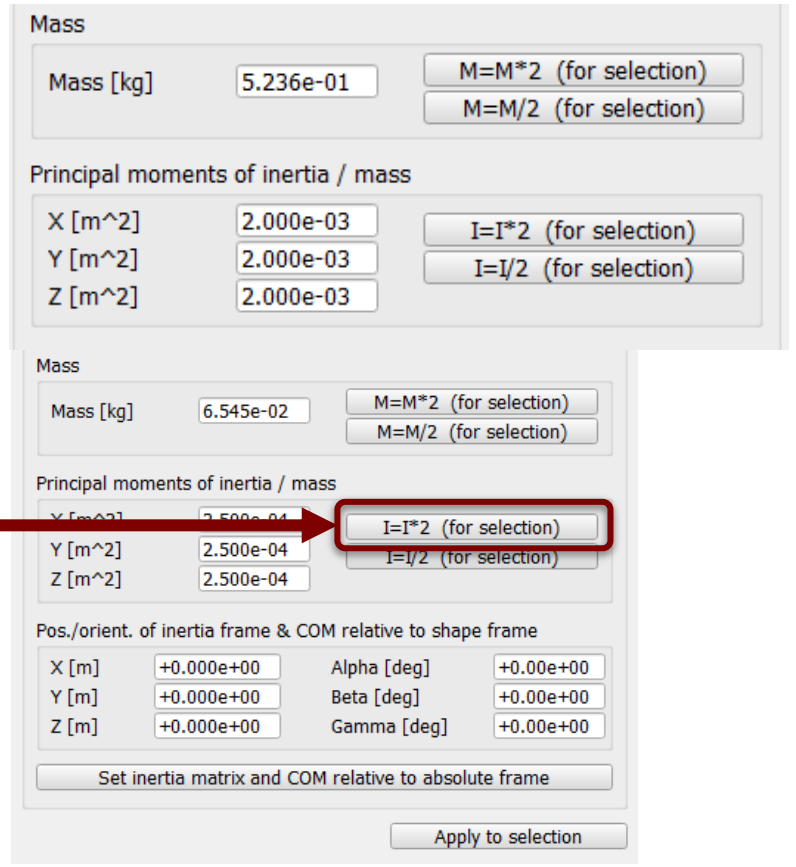
STEP 25

Repeat the step for Inertia. Select the two wheels and the slider, and in the shape dynamics dialog we click three times I=I*2 (for selection).



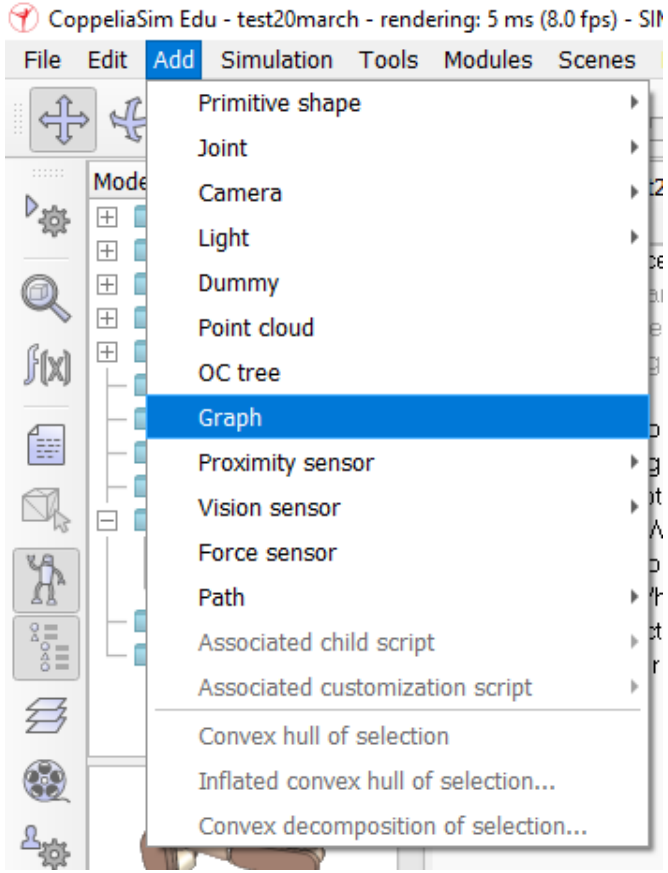


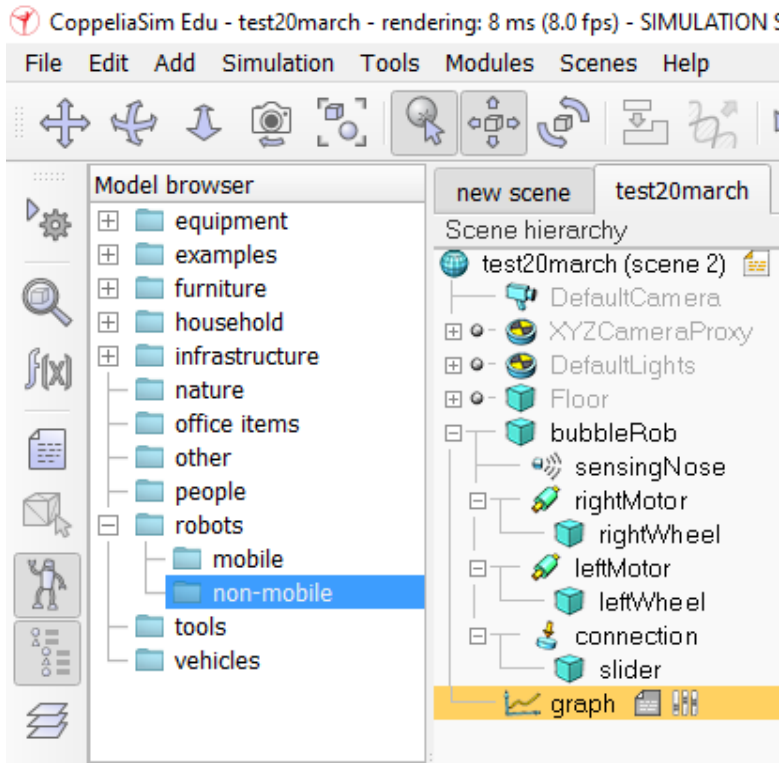
Click on this 3 times



STEP 26

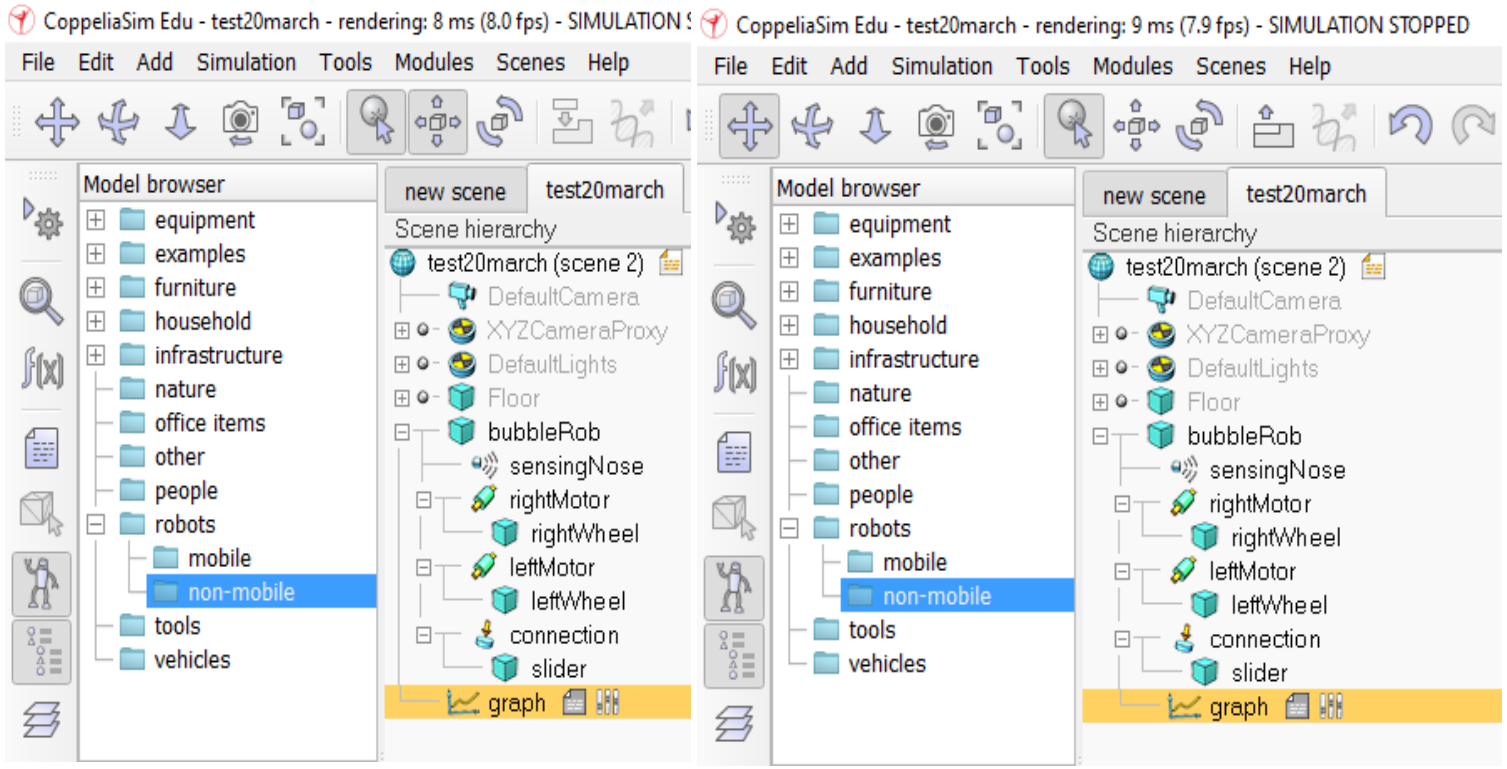
Add a graph object to BubbleRob in order to display its clearance distance. We click [Menu bar --> Add --> Graph] and rename it to graph.

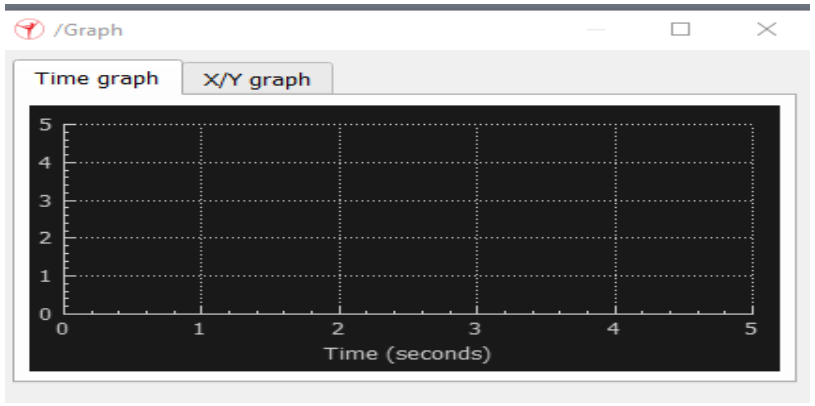


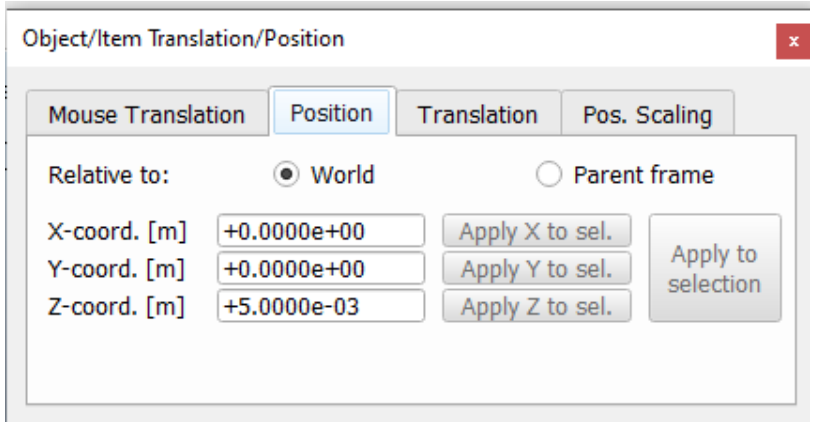


STEP 27

We attach the graph to bubbleRob, and set the graph's absolute coordinates to (0,0,0.005).







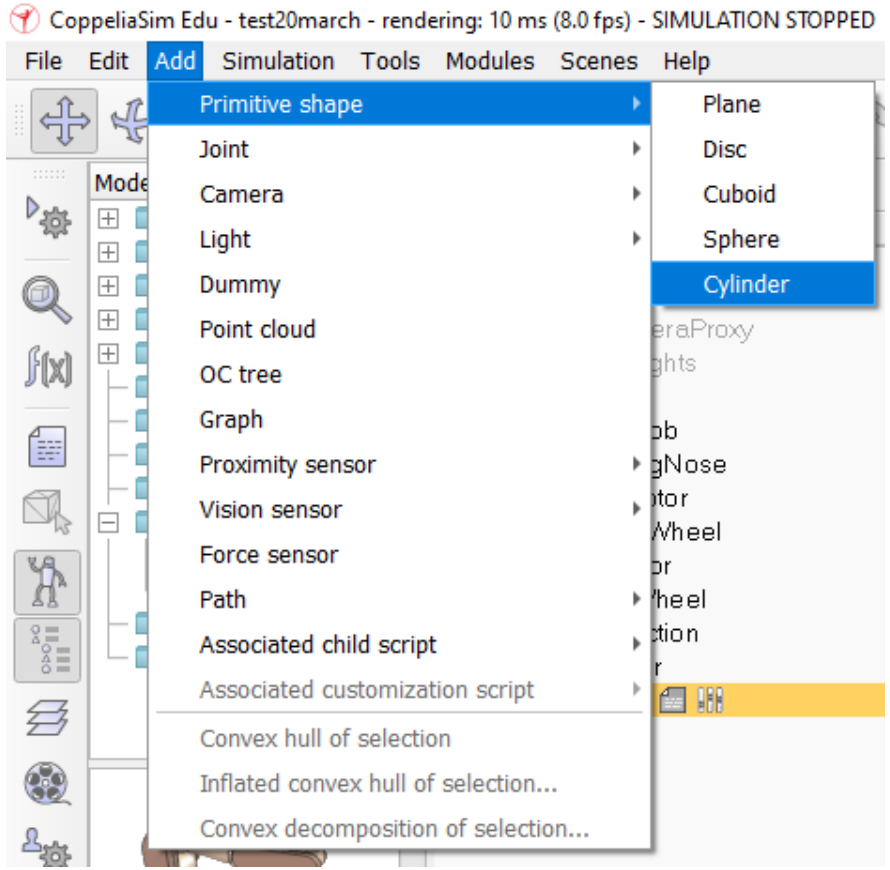
We add a pure primitive cylinder with following dimensions: (0.1, 0.1, 0.2).

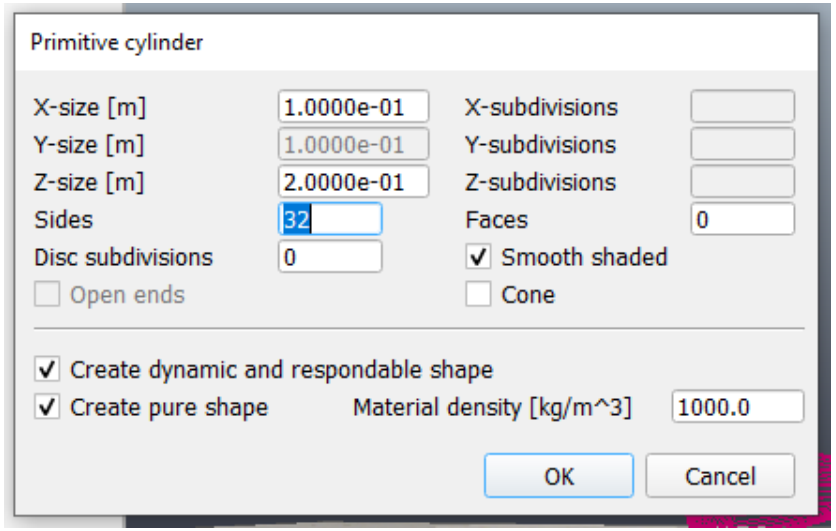
We want this cylinder to be static (i.e. not influenced by gravity or collisions) but still exerting some collision responses on non-static respondable shapes.

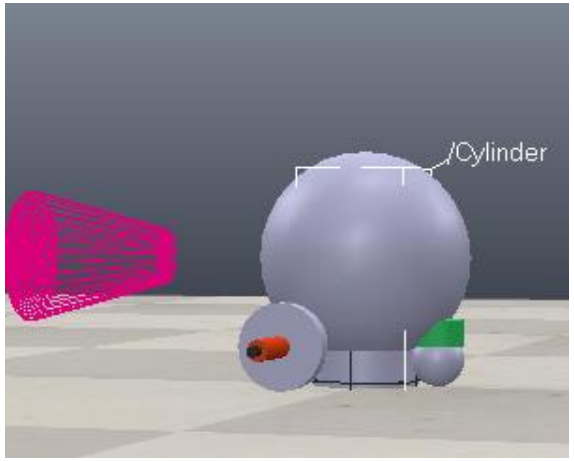
For this, we disable Body is dynamic in the shape dynamics properties.
We also want our cylinder to be Collidable, Measurable and Detectable.

STEP 28

We add a pure primitive cylinder with following dimensions: (0.1, 0.1, 0.2).

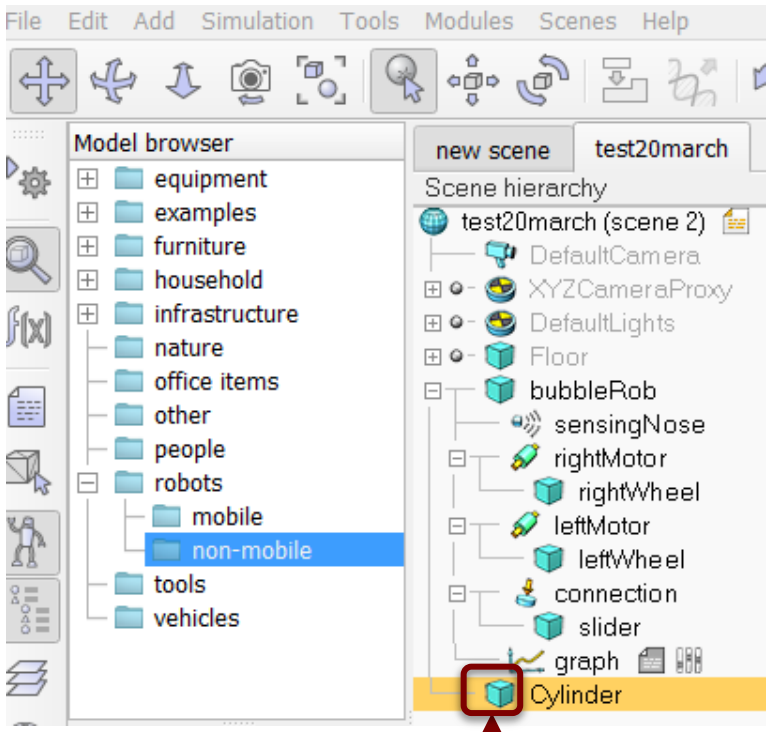




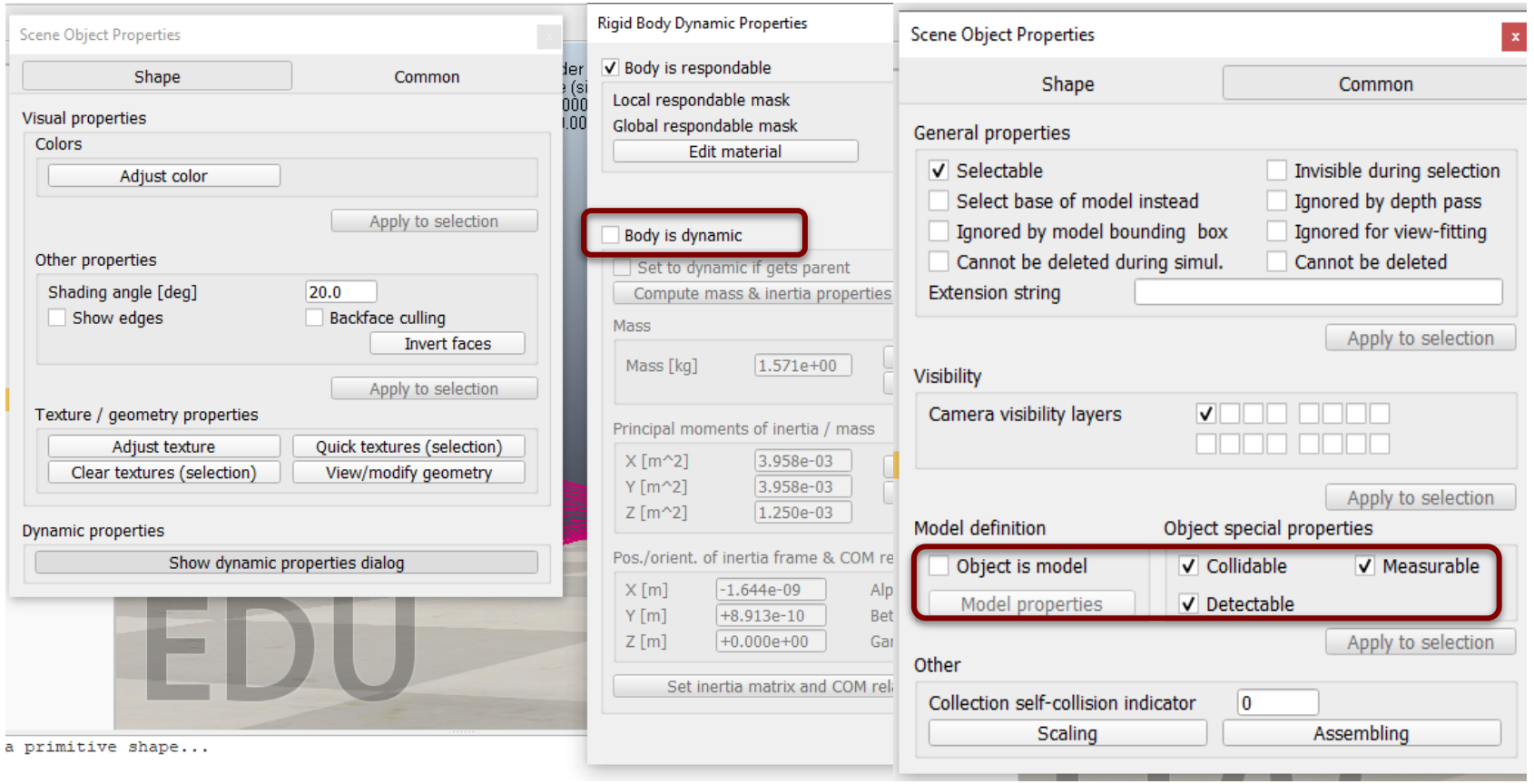


Disable Body is dynamic in the shape dynamics properties.

We also want our cylinder to be Collidable, Measurable and Detectable.



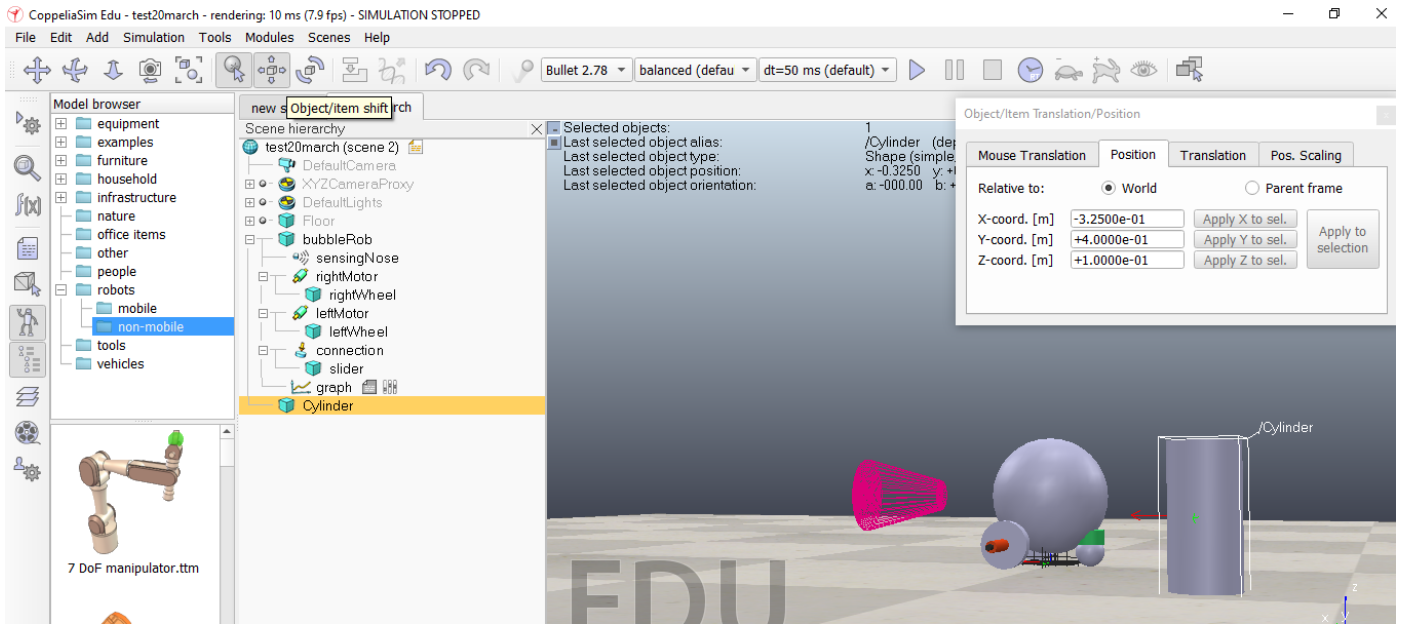
Double Click on teal colour shape

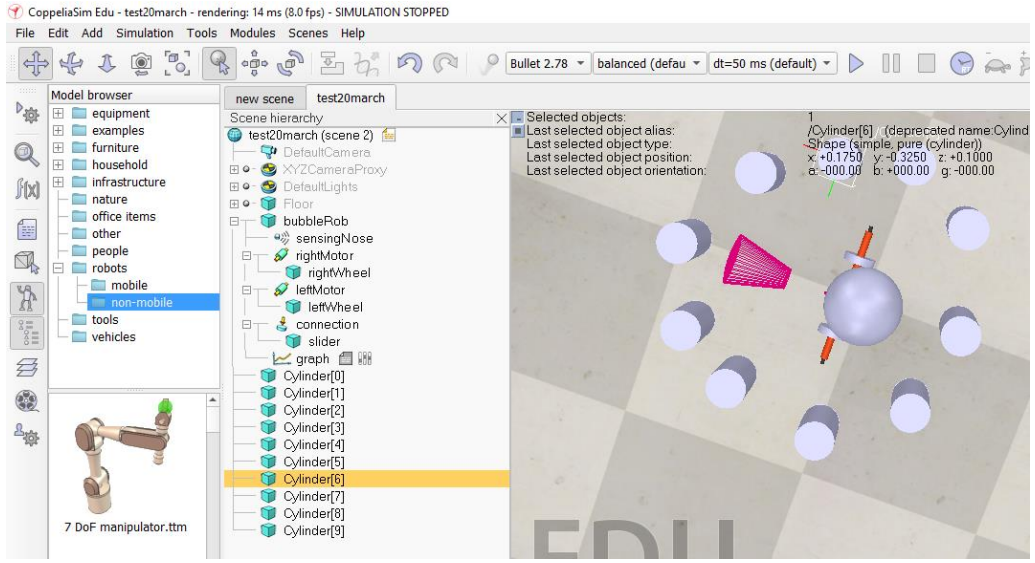


Now we can drag any point in the scene: the cylinder will follow the movement while always being constrained to keep the same Z-coordinate.

We copy and paste the cylinder a few times, and move them to positions around BubbleRob.

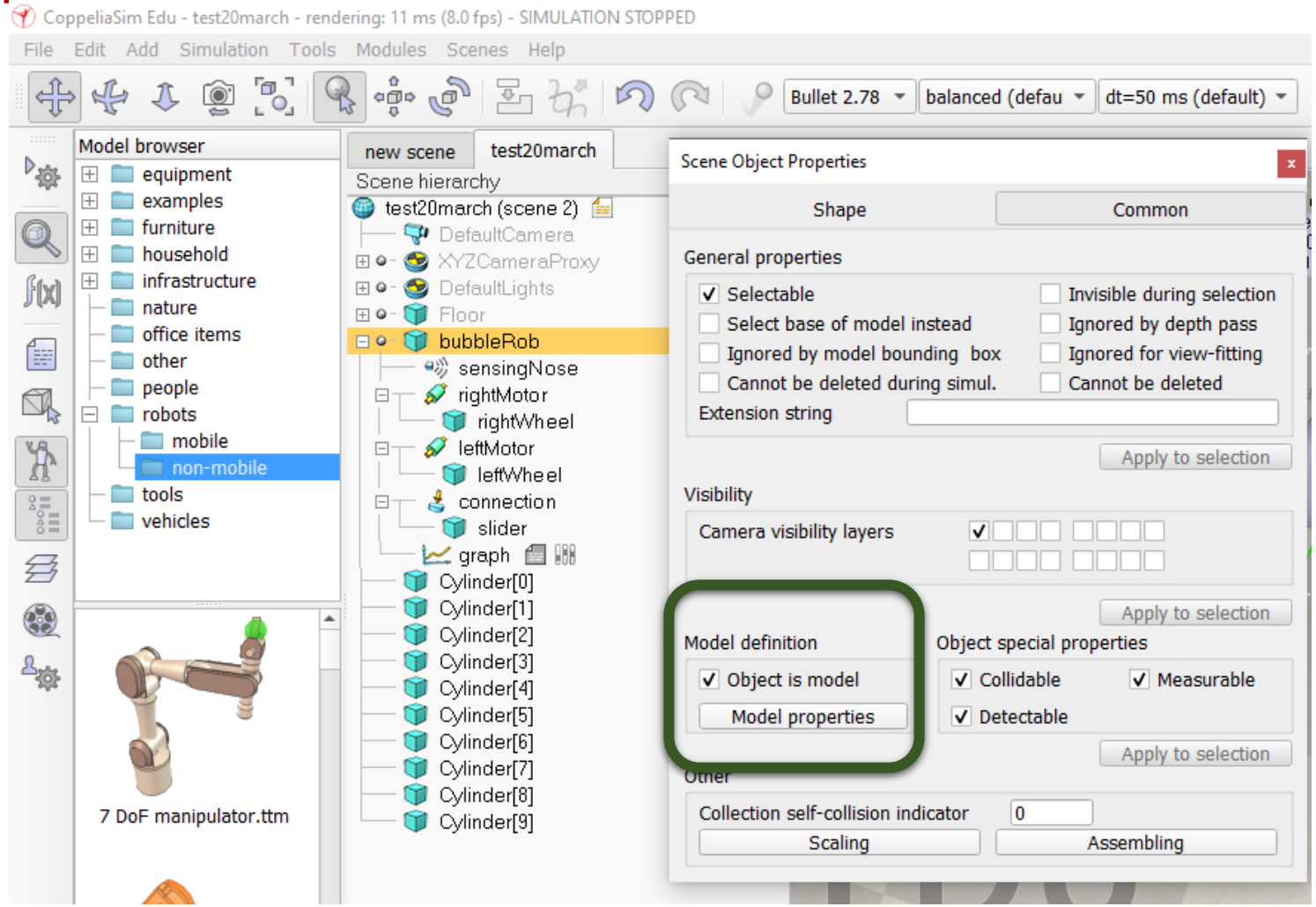
- During object shifting, holding down the shift key allows to perform smaller shift steps. Holding down the ctrl key allows to move in an orthogonal direction to the *regular* direction(s). When done, select the camera pan toolbar button again:





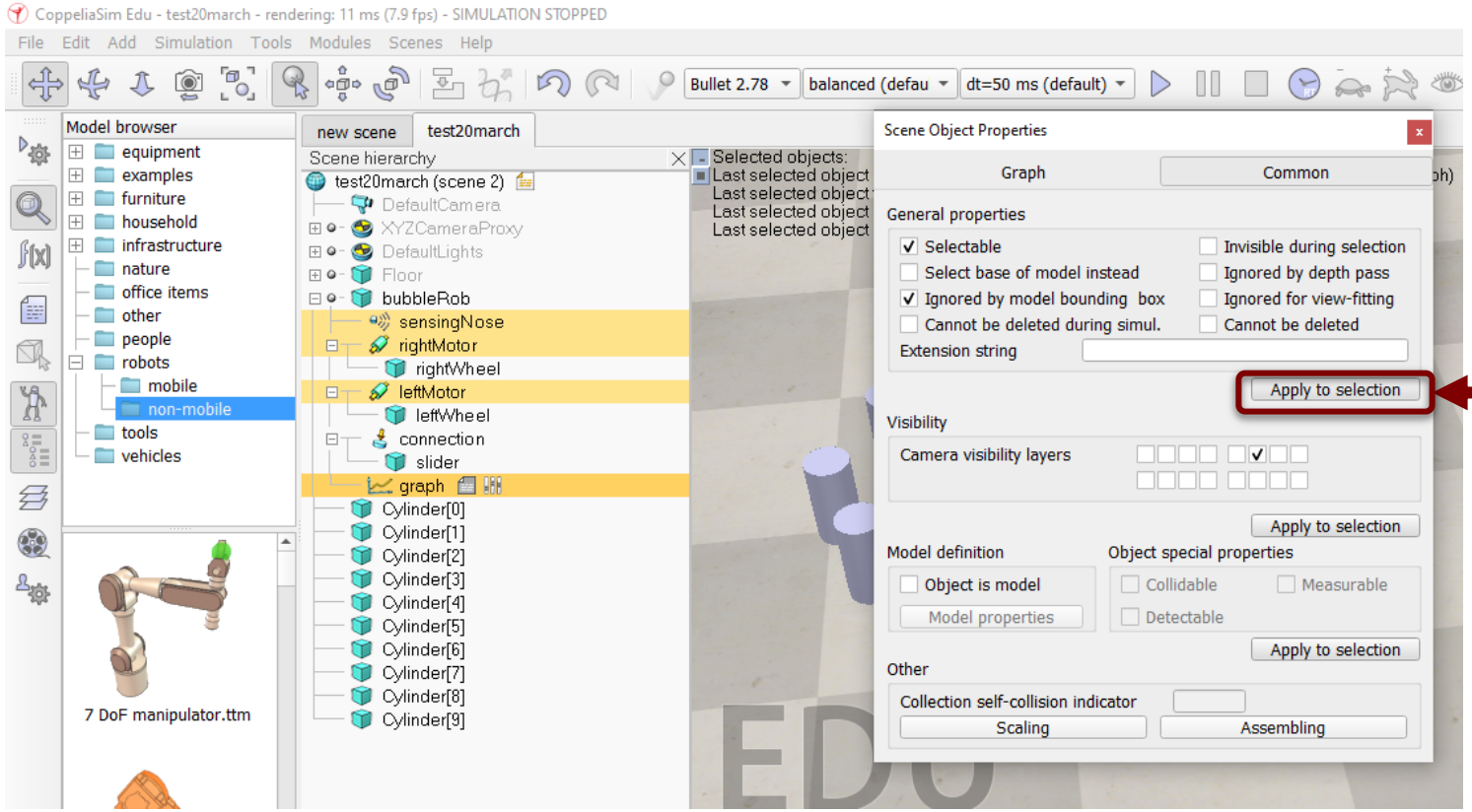
STEP 29

We now need to finish BubbleRob as a model definition.



There is now a stippled bounding box that encompasses all objects in the model hierarchy.

We select the two joints, the proximity sensor and the graph, then enable item Ignored by model bounding box and click Apply to selection, in the same dialog: the model bounding box now ignores the two joints and the proximity sensor.



Click on this

prashant.e9437@cumail.in

Mb: 9411047357