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Simulation of a serial topology robot operation using the 3DEXPERIENCE platform

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Abstract. *The paper presents the assembling of a 3D model serial topology robot, the definition of kinematical joints of the guiding device mechanism and the simulation of robot operation, using the 3DEXPERIENCE platform. In the end, there are presented different positions of the robot during simulation.*

Keywords: *serial topology, robot, 3DEXPERIENCE platform.*

1. Introduction

Serial topology robots are widely used in industrial and service applications.

The guiding device mechanism of this type of robots contains an open kinematical chain, the links being connected by the kinematical joints one after another. An example is shown in fig. 1.

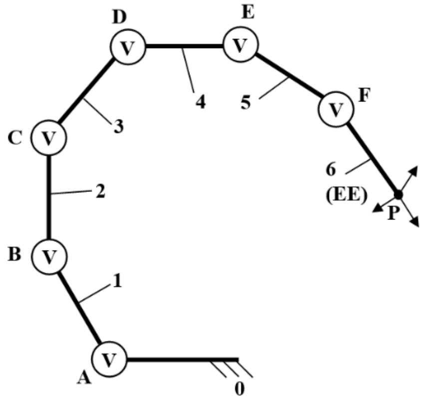

Figure 1. Structural scheme of a serial topology mechanism [1].

The mechanism has 7 binary links (0 - 6) and 6 kinematical joints of fifth class (A – F).

The serial topology robot which will be simulated is presented in fig. 2. The components were obtained by 3D printing [2].

Figure 2. The serial topology robot [2].

2. The 3DEXPERIENCE Platform

3DEXPERIENCE (3DX) is a business and innovation platform that provides organizations with a holistic, real-time vision of their business activity and ecosystem. It connects people, ideas, data and solutions in a single collaborative environment [3].

It includes many design applications and modules, as Design with CATIA V5, Part Design, Assembly Design, Design with Solidworks, xDesign, etc.

The files can be created on a PC using a design software as CATIA V5 [4], [5], and then uploaded on the platform, or can be created, edited and saved directly in cloud.

Nowadays, the 3DEXPERIENCE platform is used for various engineering design projects [6], [7].

3. Assembling the 3D Model

The 3D models of the components were uploaded on the 3DEXPERIENCE platform and assembled in CATIA Assembly Design module.

First, the robot base with its motor were inserted in the new file, rigidized one to another, and then fixed in the virtual space using the *Fix* connection type, as shown in fig. 3.

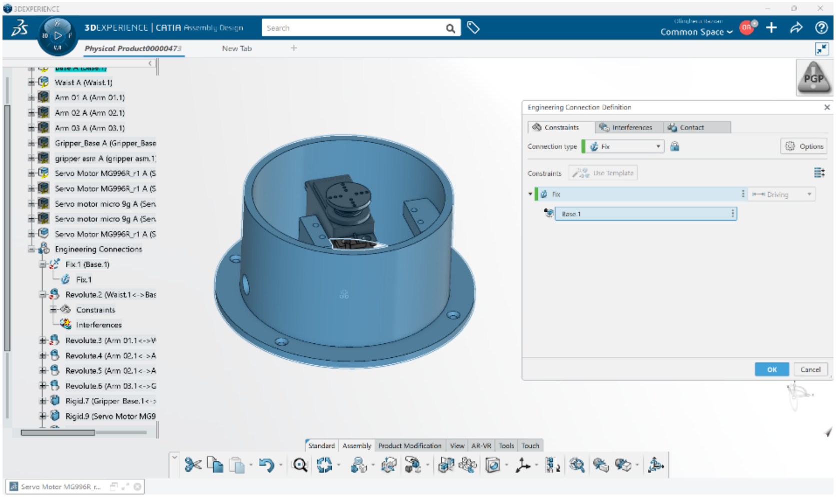

Figure 3. Inserting and fixing the robot base.

Then, the second component with its motor were inserted and connected to the base by a revolute joint with a 360° stroke, as shown in fig. 4.

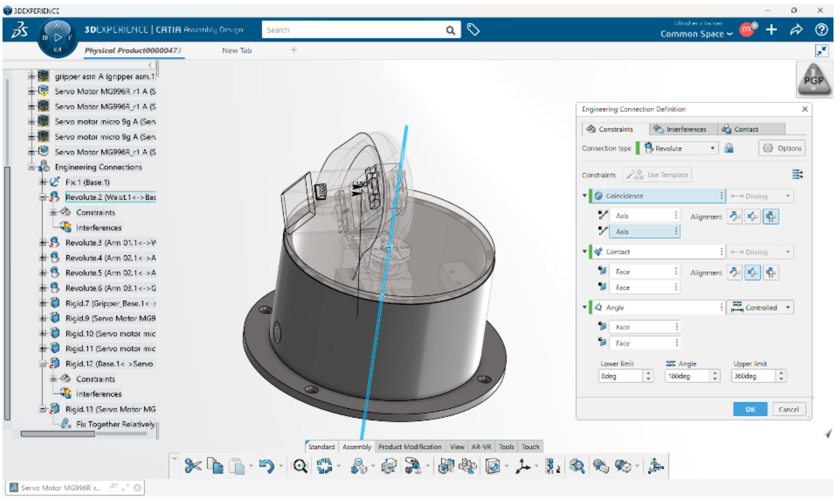

Figure 4. Defining a revolute joint between the base and the second component.

The third component was inserted next and connected to the second component by a revolute joint with a 180° stroke, as shown in fig. 5.

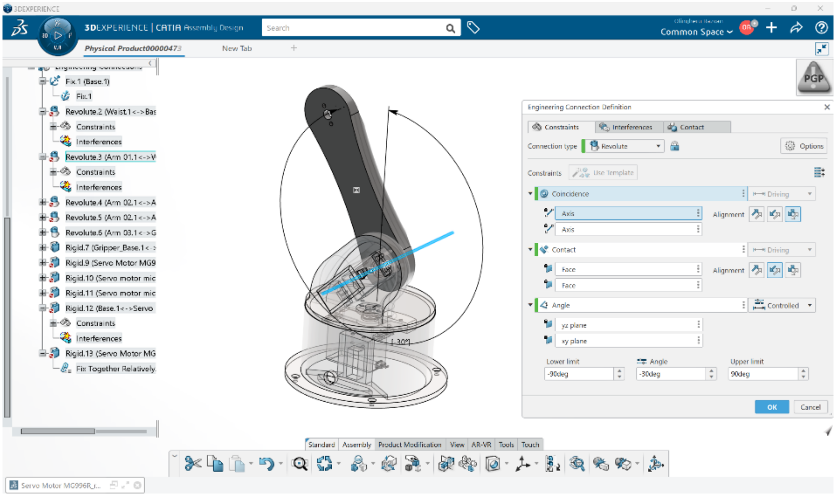

Figure 5. Defining a revolute joint between the second and the third components.

Next, the fourth component with its two motors were inserted and connected to the third component by a revolute joint with a 248° stroke, as shown in fig. 6.

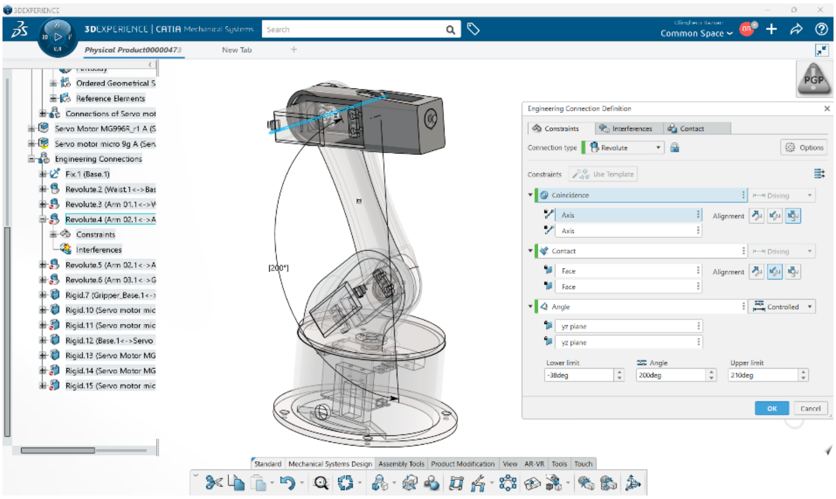

Figure 6. Defining a revolute joint between the third and the fourth components.

Then, the fifth component with its motor were inserted and connected to the fourth component by a revolute joint with a 360° stroke, as shown in fig. 7.

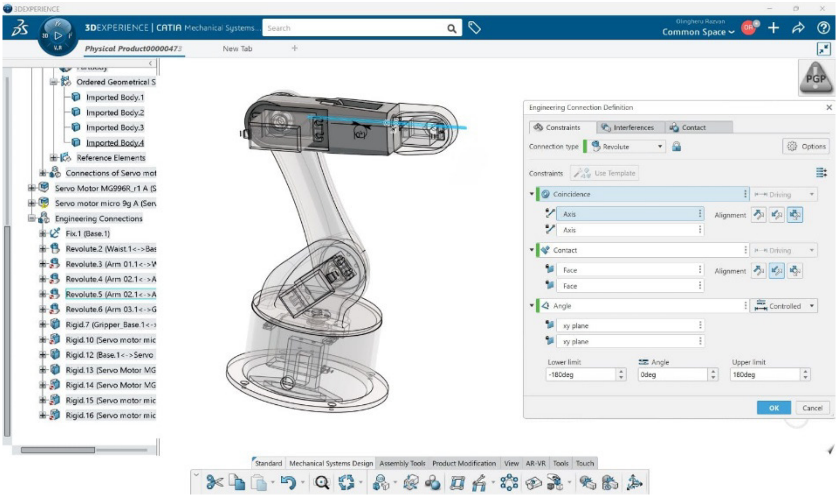

Figure 7. Defining a revolute joint between the fourth and the fifth components.

The sixth component (the end effector) with its motor were inserted and connected to the fifth component by a revolute joint with a 180° stroke, as shown in fig. 8.

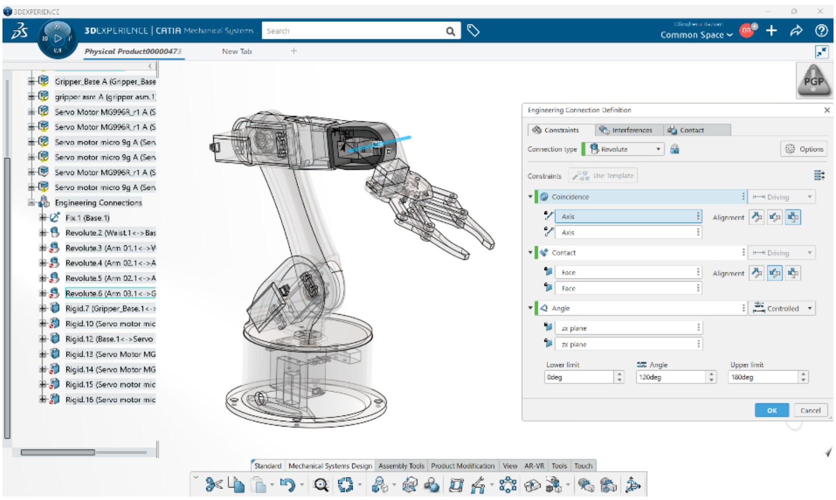

Figure 8. Defining a revolute joint between the fifth and the sixth components.

4. Simulation of the Robot Operation

The simulation of the 3D model of the serial topology robot operation was accomplished using the Mechanical Systems Design module.

Different positions of the robot during simulation are shown in fig. 9, 10 and 11.

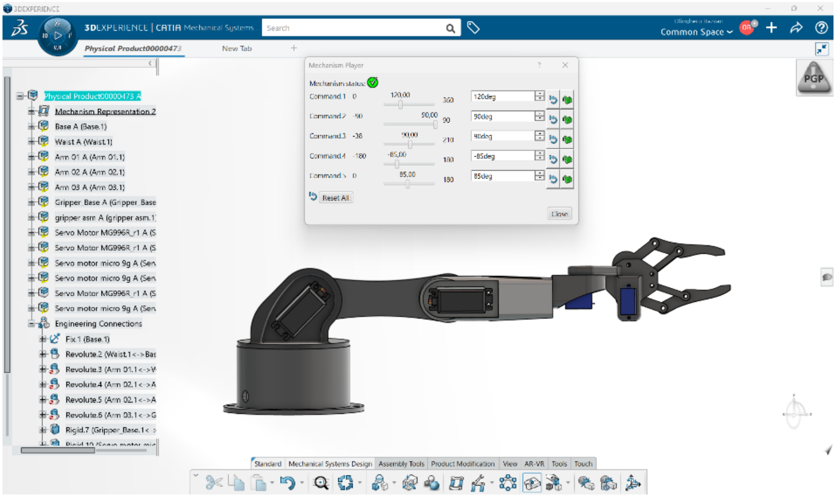

Figure 9. Horizontal position of the robot.

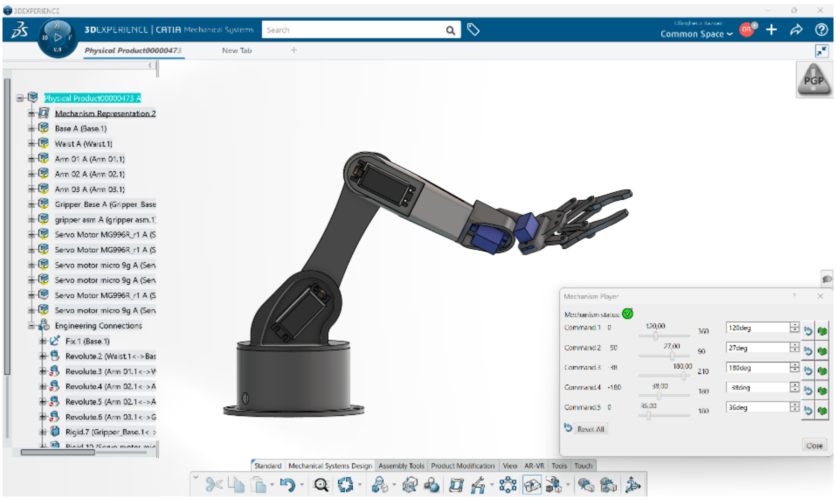

Figure 10. Intermediate position of the robot.

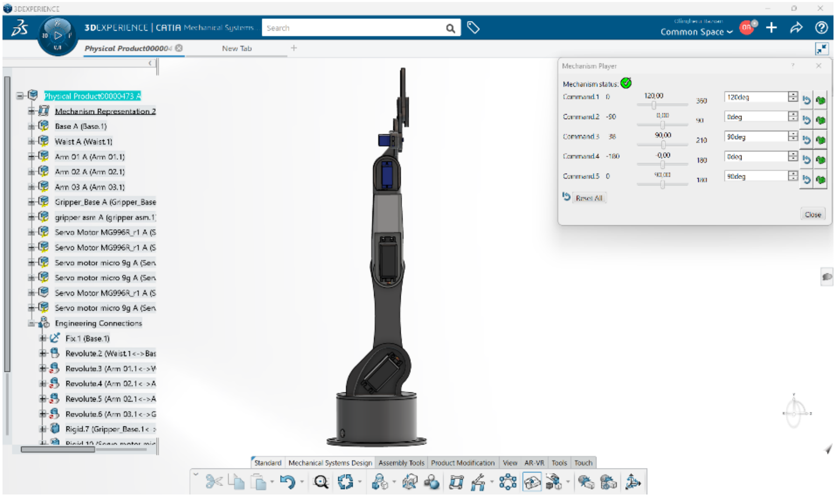

Figure 11. Vertical position of the robot.

4. Conclusions

The 3DEXPERIENCE platform represents a powerful tool for engineering design and simulation.

Using the steps presented in this paper, the operation of different types of mechanical systems can be done.

References

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