



AUTOMATION AND ROBOTIC PROJECT 1

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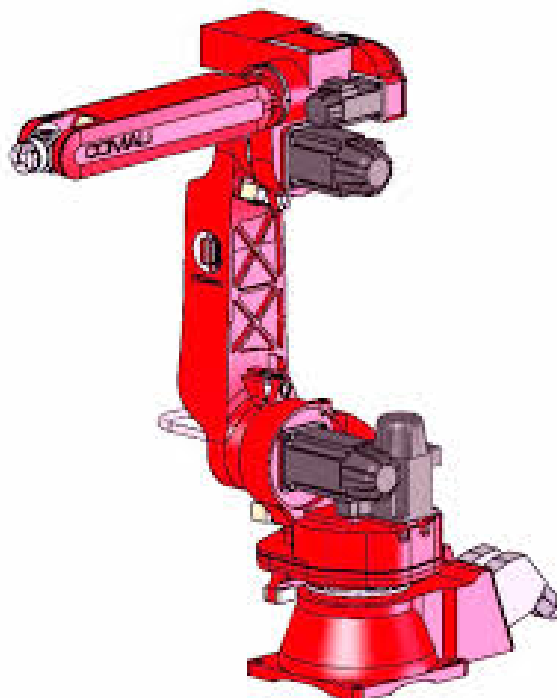


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Chapter 1

Introduction

In this project we apply the theory seen in automatic and robotic course. The aim is creating a function that returns the most important parameters for moving the end-effector of the robot. We can see it on the figure 1 with it's own axes "ANS". This parameters are the position and the orientation of the end-effector, the rotation matrix of the end-effector and the roto-translation matrices for the differents input parameters (angles and translations of the joints).

The function takes two parameters, the first is a vector values repressenting the translation or the rotation of each axe. The is the type of representation we are in. It can be "ZYZ" or "RPY" (roll, pitch, yaw).

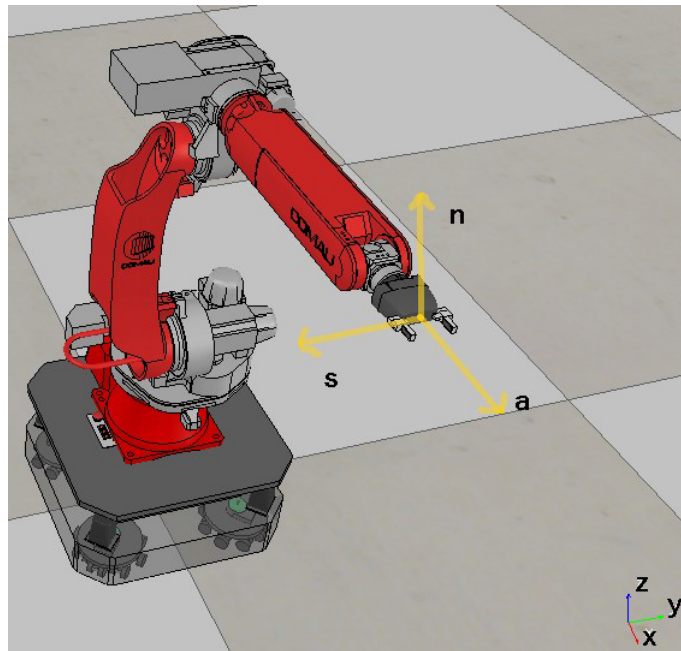


Figure 1.1: Robot smart5 six with a pince on the end-effector

Chapter 2

Work

2.1 Compute the roto-translation matrix

2.1.1 Required

To get the roto-translation matrix we need to multiply the different matrices for each junction and the A_0^b and A_e^n which are two constant matrix respectively represent the b to 0 transformation matrix and the n to e transformation matrix.

We also need the α angles for each junction. We put them in a vector called α_i which is $[\frac{\pi}{2} \quad \frac{\pi}{2} \quad \frac{-\pi}{2} \quad 0 \quad \frac{-\pi}{2} \quad \frac{\pi}{2} \quad \frac{-\pi}{2} \quad 0]$. We obtain this values by comparing the junction i 's Z axis with the $(i - 1)$'s Z axis.

On the figure 2.1.1 we can see the different axes of the robot. Each line correspond to a axe and the Z vector corresponds to the rotation axe. Then, if we take the second line, we have to make a clockwise rotation of $\frac{\pi}{2}$ to get its Z axe.

We also need a vector that we will call a that stores the distances between the axes that have the same Z orientation 2 by 2. We get this values in on the figure 4 of the documentation of the project. With the same figure we fill the d_i vector which stores the distance of the axes that doesn't have the same Z orientation. Finally, we create the $teta_i$ vector to store the angles of in parameter of the function.

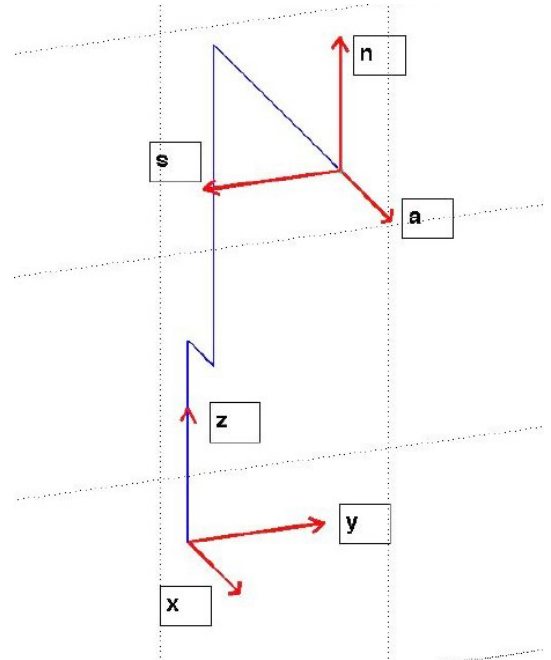


Figure 2.1: Stick view of the Smart5 Six

2.1.2 Compute the matrix

We learned during the lessons that : $A_i^{i-1}(q_i) = A_{i'}^{i-1} A_i^{i'} =$

$$\begin{bmatrix} c\theta_i & -s\theta_i c\alpha_i & s\theta_i s\alpha_i & a_i c\theta_i \\ s\theta_i & c\theta_i c\alpha_i & -c\theta_i s\alpha_i & a_i s\theta_i \\ 0 & s\alpha_i & c\alpha_i & d_i \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

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