Robotics Tutorial 1

Forward kinematics of SCARA robot

Let consider the robot given in Fig 1. Composed of four axes, the robot has a RRPR structure (known as SCARA structure, Selective Compliant Assembly Robot Arm). According to the posture (configuration) illustrated in Fig. 1, all the joint variables are null (zero).
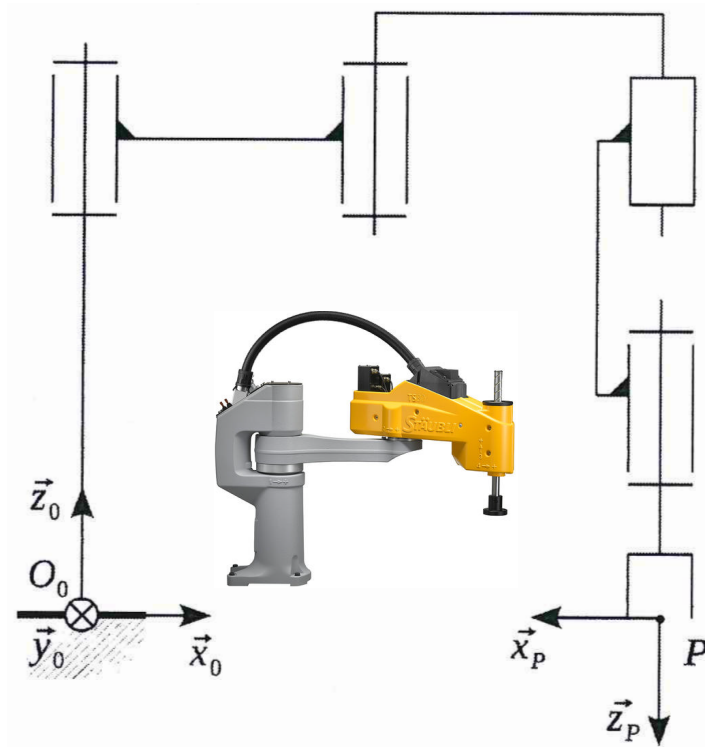

FIGURE 1 – SCARA robot

1.a Attach frames R_1, R_2, R_3 and R_4 to each axis.

1.b Compute ${}^0T_1, {}^1T_2, {}^2T_3, {}^3T_4$, ${}^4T_P$ and ${}^0T_P$.

1.c Express the forward kinematic model of the robot.

1.d Check the validity of the model by using some trivial postures.

1.e Express the rotation of the robot tool using Euler (yaw, pitch, roll) angles.

1.f Plot the projection of the robot working domain (area) relative to $O_0\overrightarrow{x_0}\overrightarrow{y_o}$ plan. Robot mechanical stops are as follows : $q_1 \in [-\frac{2\pi}{3}, \frac{2\pi}{3}]$; $q_2 \in [-\frac{2\pi}{3}, \frac{2\pi}{3}]$.