Robotics Assignment #03

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Task 3.1. 1)

2)

Task 3.2. 1) The coordinate frames of the manipulator are chosen with respect to the modified Denavit-Hartenberg-convention.

Link i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0

2)

Task 3.3. 1) To calculate ${}^{base}T_{object}$, we need to invert the transformation ${}^{camera}T_{base}$. Then we can determine the desired transformation by computing

$$\begin{aligned} {}^{base}T_{object} &= {}^{camera}T_{base}{}^{-1} \cdot {}^{camera}T_{object} \\ &= {}^{base}T_{camera} \cdot {}^{camera}T_{object} \end{aligned}$$

The inverse of ${}^{camera}T_{base}$ is

$$\begin{pmatrix} 0 & -1 & 0 & 25 \\ -1 & 0 & 0 & 15 \\ 0 & 0 & -1 & 20 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

so we can compute the resulting matrix now

$$\begin{aligned} {}^{base}T_{object} &= {}^{camera}T_{base}{}^{-1} \cdot {}^{camera}T_{object} \\ &= \begin{pmatrix} 0 & -1 & 0 & 25 \\ -1 & 0 & 0 & 15 \\ 0 & 0 & -1 & 20 \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & -5 \\ 0 & 0 & -1 & 19 \\ 0 & 0 & 0 & 1 \end{pmatrix} \\ &= \begin{pmatrix} 1 & 0 & 0 & 30 \\ 0 & 1 & 0 & 15 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} \end{aligned}$$

We can see, that the resulting homogeneous transformation is only a translation. This makes sense, because both the coordinate frame axes of the base and the part are parallel to each other.

2)