关节	$\alpha_{i-1}(rad)$	$a_{i-1}(m)$	$d_i(m)$	$\theta_i(rad)$
1	0	0	0.230	θ_1
2	$-\frac{\pi}{2}$	0	-0.054	θ_2 $(-\frac{\pi}{2})$
3	0	0.185	0	θ_3
4	0	0.17	0.077	θ_4 $(\frac{\pi}{2})$
5	$\frac{\pi}{2}$	0	0.077	θ_5 $(\frac{\pi}{2})$
6	$\frac{\pi}{2}$	0	0.0855	θ_6

$$
{}^{i-1}_{i}T = \begin{bmatrix} \cos\theta_i & -\sin\theta_i & 0 & a_{i-1} \\ \sin\theta_i\cos\alpha_{i-1} & \cos\theta_i\cos\alpha_{i-1} & -\sin\alpha_{i-1} & -\sin\alpha_{i-1}d_i \\ \sin\theta_i\sin\alpha_{i-1} & \cos\theta_i\sin\alpha_{i-1} & \cos\alpha_{i-1} & \cos\alpha_{i-1}d_i \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
{}^{0}_{1}T = \begin{bmatrix} c\theta_1 & -s\theta_1 & 0 & 0 \\ s\theta_1 & c\theta_1 & 0 & 0 \\ 0 & 0 & 1 & 0.23 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad {}^{1}_{2}T = \begin{bmatrix} c\theta_2 & -s\theta_2 & 0 & 0 \\ 0 & 0 & 1 & -0.054 \\ -s\theta_2 & -c\theta_2 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
{}^{2}_{3}T = \begin{bmatrix} c\theta_3 & -s\theta_3 & 0 & 0.185 \\ s\theta_3 & c\theta_3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad {}^{3}_{4}T = \begin{bmatrix} c\theta_4 & -s\theta_4 & 0 & 0.17 \\ s\theta_4 & c\theta_4 & 0 & 0 \\ 0 & 0 & 1 & 0.077 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
{}^{4}_{5}T = \begin{bmatrix} c\theta_5 & -s\theta_5 & 0 & 0 \\ 0 & 0 & -1 & -0.077 \\ s\theta_5 & c\theta_5 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad {}^{5}_{6}T = \begin{bmatrix} c\theta_6 & -s\theta_6 & 0 & 0 \\ 0 & 0 & -1 & -0.0855 \\ s\theta_6 & c\theta_6 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
{}^{0}_{6}T = \begin{bmatrix} r_{11} & r_{12} & r_{13} & p_x \\ r_{21} & r_{22} & r_{23} & p_y \\ r_{31} & r_{32} & r_{33} & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
\begin{aligned}
r_{11} =& s234c1s6 - c6(s1s5 - c234c1c5) \\
r_{12} =& s6(s1s5 - c234c1c5) + s234c1c6 \\
r_{13} =& c5s1 + c234c1s5 \\
r_{21} =& c6(c1s5 + c234c5s1) + s234s1s6 \\
r_{22} =& s234c6s1 - s6(c1s5 + c234c5s1) \\
r_{23} =& c234s1s5 - c1c5 \\
r_{31} =& c234s6 - s234c5c6 \\
r_{32} =& c234c6 + s234c5s6 \\
r_{33} =& -s234s5 \\
p_x =& 0.185c1c2 - 0.023s1 + (0.171c5s1)/2 - 0.17c1s2s3 \\
& + (0.0171c234c1s5)/2 + 0.077c23c1s4 + 0.077s23c1c4 + 0.17c1c2c3 \\
p_y =& 0.023c1 - (0.171c1c5)/2 + 0.185c2s1 - 0.17s1s2s3 \\
& + (0.171c234s1s5)/2 + 0.077c23s1s4 + 0.077s23c4s1 + 0.17c2c3s1 \\
p_z =& 0.077c23c4 - 0.185s2 - 0.077s23s4 - s5((0.171c23s4)/2 \\
& + (0.171s23c4)/2) - 0.17s23 + 0.23
\end{aligned}
$$

机器人逆运动学部分：

$$
{}^{2}_{6}T = \begin{bmatrix} r'_{11} & r'_{12} & r'_{13} & p'_x \\ r'_{21} & r'_{22} & r'_{23} & p'_y \\ r'_{31} & r'_{32} & r'_{33} & p'_z \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
\begin{aligned}
r'_{11} =& s34s6 + c34c5c6 \\
r'_{12} =& s34c6 - c34c5s6 \\
r'_{13} =& c34s5 \\
r'_{21} =& s34c5c6 - c34s6 \\
r'_{22} =& -c34c6 - s34c5s6 \\
r'_{23} =& s34s5 \\
r'_{31} =& c6s5 \\
r'_{32} =& -s5s6 \\
r'_{33} =& -c5 \\
p'_x =& 77s34 + 170c3 + 171c34s5/2 + 185 \\
p'_y =& 170s3 - 77c34 + 171s34s5/2 \\
p'_z =& 77 - 171c5/2
\end{aligned}
$$

又有

$$
{}^2_6T = {}^1_2T^{-1} \quad {}^0_1T^{-1} \quad {}^0_6T = \begin{bmatrix} r'_{11} & r'_{12} & r'_{13} & p'_x \\ r'_{21} & r'_{22} & r'_{23} & p'_y \\ r'_{31} & r'_{32} & r'_{33} & p'_z \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
\begin{aligned}
r'_{11} =& r_{11}c1c2 - r_{31}s2 + r_{21}c2s1 \\
r'_{12} =& r_{12}c1c2 - r_{32}s2 + r_{22}c2s1 \\
r'_{13} =& r_{13}c1c2 - r_{33}s2 + r_{23}c2s1 \\
r'_{21} =& - r_{31}c2 - r_{11}c1s2 - r_{21}s1s2 \\
r'_{22} =& - r_{32}c2 - r_{12}c1s2 - r_{22}s1s2 \\
r'_{23} =& - r_{33}c2 - r_{13}c1s2 - r_{23}s1s2 \\
r'_{31} =& r_{21}c1 - r_{11}s1 \\
r'_{32} =& r_{22}c1 - r_{12}s1 \\
r'_{33} =& r_{23}c1 - r_{13}s1 \\
p'_x =& 230s2 - p_z s2 + p_x c1c2 + p_y c2s1 \\
p'_y =& 230c2 - p_z c2 - p_x c1s2 - p_y s1s2 \\
p'_z =& p_y c1 - p_x s1 + 54
\end{aligned}
$$

$$
p'_z - \frac{171}{2}r'_{33} = 77 = (p_y - \frac{171}{2}r_{23})c1 - (p_x - \frac{171}{2}r_{13})s1 + 54
$$

$$
(p_y - \frac{171}{2}r_{23})c1 - (p_x - \frac{171}{2}r_{13})s1 = 23
$$

$$
a\cos\theta + b\sin\theta = c
$$

$$
\theta = 2\arctan\left(\frac{b \pm \sqrt{b^2 + a^2 - c^2}}{a + c}\right)
$$

$$
\theta_5 = \pm\arccos(r'_{33}) \quad \theta_6 = \arctan\left(\frac{-r'_{32}}{r'_{31}}\right)(+\pi)
$$

$${}^1_4T = {}^0_1T^{-1}\ {}^0_6T\ {}^5_6T^{-1}\ {}^4_5T^{-1} = {}^1_2T^2_3T^3_4T$$

$$
{}^1_4T = \begin{bmatrix}
c234 & -s234 & 0 & 0.17c23 + 0.185c2 \\
0 & 0 & 1 & 0.023 \\
-s234 & -c234 & 0 & -0.17s23 - 0.185s2 \\
0 & 0 & 0 & 1
\end{bmatrix}
$$