◂ Camera 14:40 Tue 9 Jan
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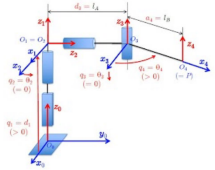
1. Pls upload the solution.

DH Table for 4-dof PRRR spatial manipulator



Kinematics	θ_i Theta [rad]	d_i [m]	a_i [m]	α_i alpha [rad]
Joint 1	0	$2a_1$	0	0
Joint 2	θ_2	0	0	- 90°
Joint 3	θ_3	l_A	0	0
Joint 4	θ_4	0	l_B	0

note that

1. θ_i (theta) = How much to rotate along Z_{i-1} axis to align X_{i-1} and X_i
2. d_i = How much to translate along Z_{i-1} axis to align O_{i-1} and O_i
3. a_i = How much to translate along X_i axis to align O_{i-1} and O_i
4. α_i (alpha) = How much to rotate along X_i axis to align Z_{i-1} and Z_i

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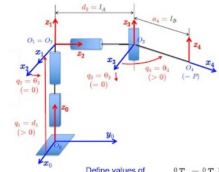
2. Pls upload the solution.

DH Table for 4-dof PRRR spatial manipulator



Kinematics	θ_i Theta [rad]	d_i [m]	a_i [m]	α_i alpha [rad]
Joint 1	0	q1	0	0
Joint 2	$\theta 2$	0	0	$-\pi/2$
Joint 3	$\theta 3$	l_A	0	$\pi/2$
Joint 4	$\theta 4$	0	l_B	0

note that

1. θ_i (theta) = How much to rotate along Z_{i-1} axis to align X_{i-1} and X_i
2. d_i = How much to translate along Z_{i-1} axis to align O_{i-1} and O_i
3. a_i = How much to translate along X_i axis to align O_{i-1} and O_i
4. α_i (alpha) = How much to rotate along X_i axis to align Z_{i-1} and Z_i

Define values of
d1 = 2 m
θ2 = 90 deg
θ3 = 0 deg
θ4 = 60 deg
l_A = 2 m
l_B = 1 m

$^0T_4 = {}^0T_1{}^1T_2{}^2T_3{}^3T_4 = ?$

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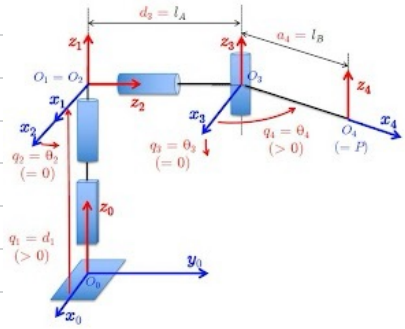
DH Table for 4-dof PRRR spatial manipulator



Kinematics	θ_i Theta [rad]	d_i [m]	a_i [m]	α_i alpha [rad]
Joint 1	0	q_1	0	0
Joint 2	θ_2	0	0	$-\pi/2$
Joint 3	θ_3	l_A	0	$\pi/2$
Joint 4	θ_4	0	l_B	0

note that

1. θ_i (theta) = How much to rotate along Z_{i-1} axis to align X_{i-1} and X_i
2. d_i = How much to translate along Z_{i-1} axis to align O_{i-1} and O_i
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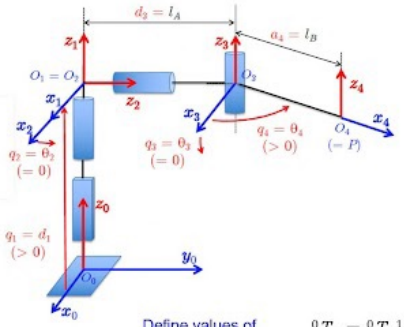
DH Table for 4-dof PRRR spatial manipulator



Kinematics	θ_i Theta [rad]	d_i [m]	a_i [m]	α_i alpha [rad]
Joint 1	0	q1 = 2	0	0
Joint 2	02 = 90	0	0	$-\pi/2 \rightarrow -90$
Joint 3	03 = 0	l_A = 2	0	$\pi/2 \rightarrow 90$
Joint 4	04 = 60	0	l_B = 1	0

note that

1. θ_i (theta) = How much to rotate along Z_{i-1} axis to align X_{i-1} and X_i
2. d_i = How much to translate along Z_{i-1} axis to align O_{i-1} and O_i
3. a_i = How much to translate along X_i axis to align O_{i-1} and O_i
4. α_i (alpha) = How much to rotate along X_i axis to align Z_{i-1} and Z_i

Define values of
d1 = 2 m
02 = 90 deg
03 = 0 deg
04 = 60 deg
l_A = 2 m
l_B = 1 m

$${}^0T_4 = {}^0T_1\,{}^1T_2\,{}^2T_3\,{}^3T_4 = ?$$

$${}^0T_1 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^1T_2 = \begin{bmatrix} 0 & 0 & -1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^2T_3 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^3T_4 = \begin{bmatrix} 0.5 & -0.87 & 0 & 0.5 \\ 0.87 & 0.5 & 0 & 0.87 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$${}^0T_4 = \begin{bmatrix} -0.87 & -0.5 & 0 & -2.87 \\ 0.5 & -0.87 & 0 & 0.5 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$