DH-KK PARAMETER ASSIGNMENT FLOWCHART

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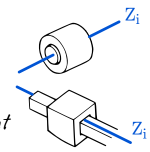
Number consecutively the joint axes from 1 to n

Assign all the $\vec{Z}i$ axes

- revolute joint
- prismatic joint

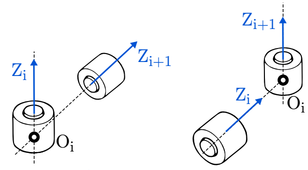


Along the ith joint axis
$\vec{Z}_i$ towards the direction to $\vec{Z}_{i+1}$ preferably
(otherwise, so as to cause the least possible change with regard to $\vec{Z}_{i-1}$)

$i = 1$

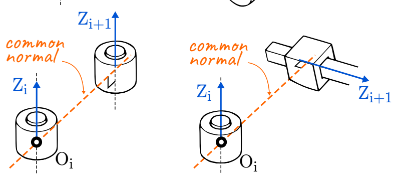
Assign Oi, the origin of frame Ri

- $\vec{Z}i$ and $\vec{Z}i+1$ intersect



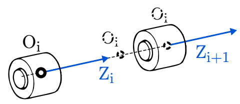
Oi located at the intersection of $\vec{Z}_i$ and $\vec{Z}_{i+1}$

- $\vec{Z}i$ and $\vec{Z}i+1$ do not intersect



Oi located at the intersection of $\vec{Z}_i$ with the common normal to axes $\vec{Z}_i$ and $\vec{Z}_{i+1}$

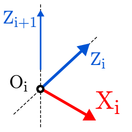
- $\vec{Z}i$ and $\vec{Z}i+1$ coaxial



Oi anywhere along the axis
(but at a known distance)

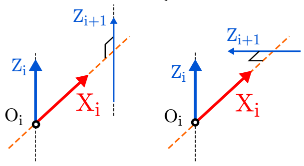
Assign $\vec{X}i$ axis

- $\vec{Z}i$ and $\vec{Z}i+1$ intersect



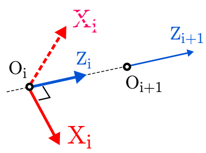
$\vec{X}_i = \vec{Z}_i \wedge \vec{Z}_{i+1}$
Choose direction freely
(but, so as to cause the least possible change with regard to $\vec{X}_{i-1}$)

- $\vec{Z}i$ and $\vec{Z}i+1$ do not intersect



Along the common normal to $\vec{Z}_i$ and $\vec{Z}i_{+1}$
(preferably pointing towards $\vec{Z}_{i+1}$)

- $\vec{Z}i$ and $\vec{Z}i+1$ coaxial



Choose direction freely but observing $\vec{X}_i \perp \vec{Z}_i$
(try to cause the least possible change with regard to $\vec{X}_{i-1}$)

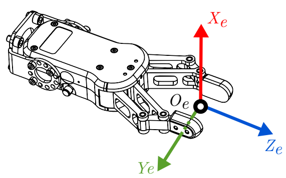
$i = n$?
- no: i ++ (return to Assign Oi)
- yes

Assign frame R_0

- If known, assign O_0 at the specified location away from O_1
- Otherwise, if not specified, assign origin O_0 to match O_1

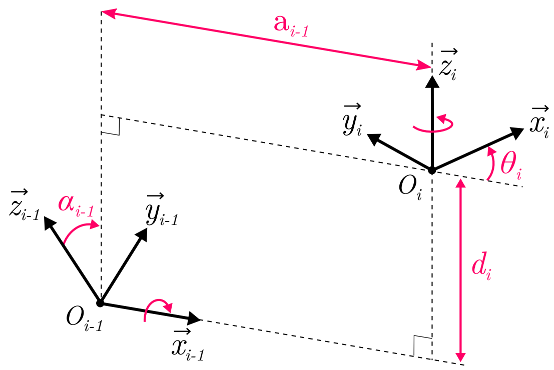
assign frame R0 to match R1 when q1 = 0

Assign end effector frame R_e



Oe located at the center of the end effector
$\vec{Z}e$ pointing in the direction of the object to be gripped
$\vec{Y}e$ perpendicular to $\vec{Z}e$ in the sliding plane of the gripper
$\vec{X}e = \vec{Y}e \wedge \vec{Z}e$ so as to obtain a right-handed frame

Symbol	Name	Description
a_{i-1}	Link Length	$Z_{i-1} \xrightarrow[@\, X_{i-1}]{\perp,\text{distance}} Z_i$
α_{i-1}	Twist Angle	$Z_{i-1} \xrightarrow[@\, X_{i-1}]{\circlearrowleft\text{rotation}} Z_i$
d_i	Joint Offset	$X_{i-1} \xrightarrow[@\, Z_i]{\perp,\text{distance}} X_i$
θ_i	Joint Angle	$X_{i-1} \xrightarrow[@\, Z_i]{\circlearrowleft\text{rotation}} X_i$



Fill in the DHKK table

Check that you have only one q variable per row

	Joint	σ_i	a_{i-1}	α_{i-1}	d_i	θ_i
${}^0T_1$	1					
${}^1T_2$	2					
…	…					
${}^{n-1}T_n$	n					

$$
{}^{i-1}T_i = \begin{bmatrix} C\theta_i & -S\theta_i & 0 & a_{i-1} \\ S\theta_i\, C\alpha_{i-1} & C\theta_i\, C\alpha_{i-1} & -S\alpha_{i-1} & -d_i\, S\alpha_{i-1} \\ S\theta_i\, S\alpha_{i-1} & C\theta_i\, S\alpha_{i-1} & C\alpha_{i-1} & d_i\, C\alpha_{i-1} \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$