Two representation { space frame / body frame

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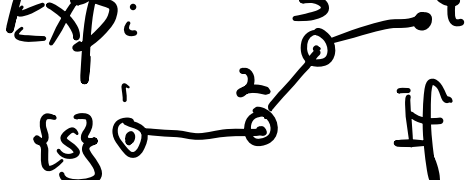
Dicided by whether pre or post multiply home config., M

Definition of thetalist: the gathering set of parameters of all joint in system. For a RPR system, thetalist is a 3x1 matrix, each one represents how far each joint goes. $\begin{bmatrix} \pi/2 \\ 2 \\ \pi/2 \end{bmatrix}$ means both R_1 and R_2 joint rotate angle of $\pi/2$ and P joint extend for 2.

Home config is the T_{sb} or T_{bs} when thetalist is $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

1. Rrepresented in {s} frame.
   > Start with the joint that the mostly far away from the frame we choose.
   > The joint between the frame we choose and current frame will influence the result with coupling complex process.

Exp:



If we chose {s} and working

on joint 3, changing joint 2 will change result of joint 3 with chaos

To summarize, to calculate the forward kinematics of an open chain using the space form of the PoE formula (4.14), we need the following elements:

(a) the end-effector configuration $M \in SE(3)$ when the robot is at its home position;

(b) the screw axes $\mathcal{S}_1, \ldots, \mathcal{S}_n$ expressed in the fixed base frame, corresponding to the joint motions when the robot is at its home position;

(c) the joint variables $\theta_1, \ldots, \theta_n$.

After we have the S and theta of a joint, we can get its SE3 by using MatrixExp.

For representation in frame {s}, if $M = T_{sb}$, pre multiply. if $M = T_{bs}$, post-multiply. From the most far point to the nearest. $T(\theta) = e^{[\mathcal{S}]\theta} e^{[\mathcal{S}_2]\theta_2} \ldots e^{[\mathcal{S}_n]\theta_n} M$ ($M = T_{sb}$)

For representation in frame {b}, Almost the same thing with inverse the sequence of pre and post multiply for those two different situations.

★ In the second step, we represent each joint in fixed frame {s}, and multiply them in sequence.

Q: Why we represent these joint in frame {s},

and then allow use them as $T_{i-1,i}$

A: The joints between the current joint and frame {s} are still in their home position, their $T = I$.

For joint 3, we have j_3 in {s}:

$$T_{s3} = T_{s1} T_{12} T_{23}$$

$$= I \times I \times I_{23}$$

$$= I_{23}$$

That explains why we need to start from the farest point to the nearest, because that guarantees that all the previous joints have a $T = I$