Report

Task1: Forward Kinematic

Product of exponentials FK formula: $$T(\theta) = e^{[\mathcal{S}_1]\theta_1} e^{[\mathcal{S}_2]\theta_2} e^{[\mathcal{S}_3]\theta_3} M$$

Where M is home position of robot. M = $\begin{matrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & l \\ 0 & 0 & 1 & h \\ 0 & 0 & 0 & 1 \end{matrix}$,

$e^{[S_i]\theta_i} = \begin{matrix} I & Sv\theta \\ 0 & 1 \end{matrix}$ *in case of translational joint* $(||Sw|| = 0)$

or $\begin{matrix} I + \sin(\theta)\,[Sw] + (1 - \cos(\theta)[Sw]^2 & (I\theta + (1 - \cos(\theta))[Sw] + (\theta - \sin(\theta))[Sw]^2)Sv \\ 0 & 1 \end{matrix}$ *in other cases,*

S is the matrix of screw vectors that consists of 3 rotational components Sw and 3 translational components Sv

S = $\begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{matrix}$

Task2: Jacobian

Product of exponentials Jacobian calculated by following algorithm:

$J_{Si} = [Ad_{e^{[S_1]\theta_1 \ldots e^{[S_{n-1}]\theta_{n-1}}}}]S_i$

Task3: visualization

Visualization goes same way as in previous home tasks by following algorithm:

1) Calculate Forward kinematic for next joint
2) Store joint coordinates
3) Repeat till endeffector

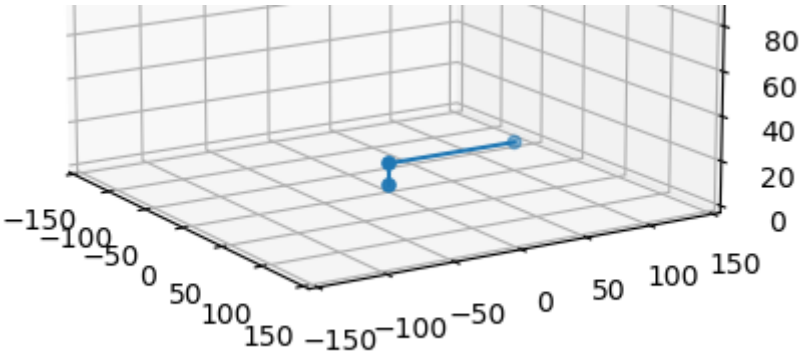

Figure 1 – robot visualization in home position

GitHub: https://github.com/EriKarasik/ARHW6