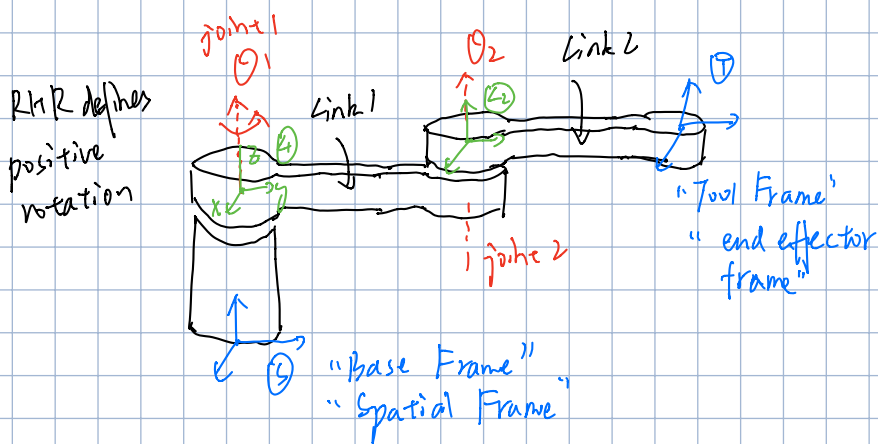


Ch 2. Kinematic Chains.

2.1 Forward Kinematics (FK) for serial chains

(A) Basic Conventions



a) links are numbered from 0 to n

b) joints are numbered from 1 to n

Joint Space Q : cartesian product of individual joint spaces Q_i :

— revolute: $Q_i = (0, 2\pi) \in S_1$

— Prismatic $Q_i = R$ (also an "angle")

$$Q = S_1 \times S_1 \times \dots \times R \times \dots$$

$$\bar{\theta} = (\theta_1, \theta_2, \dots, \theta_n) \in Q$$

FK Problem: Given joint configuration $\bar{\theta} = (\theta_1, \theta_2, \dots, \theta_n)$, what is the configuration of Tool Frame T relative to the Base frame S
 $g_{st}(\bar{\theta})$?

$$g_{st}(\bar{\theta}) = g_{sl_1}(\theta_1) \cdot g_{l_1 l_2}(\theta_2) \cdot g_{l_2 t}$$

In general: $g_{sl_1}(\theta_1) \cdot g_{l_1 l_2}(\theta_2) \cdot \dots \cdot g_{l_{n-1} l_n}(\theta_n) \cdot g_{l_n t}$

In screw kinematics:

$$g_{st}(\bar{\theta}) = e^{\hat{\xi}_1 \theta_1} \cdot e^{\hat{\xi}_2 \theta_2} \cdot \dots \cdot e^{\hat{\xi}_n \theta_n} g_{st}(\bar{\theta})$$