Summary

1. Apply D-H Representation (page 59-page 60).

2. Define the four kinematic parameters (see page 60).

3. Find Link-Coordinate Transformation (page 69).

$$T_{k-1}^{k} = \begin{pmatrix} C\theta_k & -C\alpha_k S\theta_k & S\alpha_k S\theta_k & a_k C\theta_k \\ S\theta_k & C\alpha_k C\theta_k & -S\alpha_k C\theta_k & a_k S\theta_k \\ 0 & S\alpha_k & C\alpha_k & d_k \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$T_{base}^{tool}(q) = T_0^1(q_1)T_1^2(q_2)\cdots T_{n-1}^n(q_n) = T_0^n(q\ )$$

It is often helpful to *partition* the problem at wrist.

$$T_{base}^{tool}(q) = T_{base}^{wrist}(q_1, q_2, q_3)T_{wrist}^{tool}(q_4, q_5, ..., q_n)$$

4. Find the Arm Equation (page 72).

$$T_{base}^{tool}(q) = \begin{pmatrix} & R(q) & & p(q) \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

- 3x3 matrix $R(q)$ specifies the *orientation* of the tool, while the 3x1 matrix
- $p(q)$ specifies the *position* of the tool tip.