Introduction to Robotics

Introduction to Robotics book PDF, Third Edition. *John J. Craig*,

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Chapter 2. Manipulator kinematics

2-1. Introduction

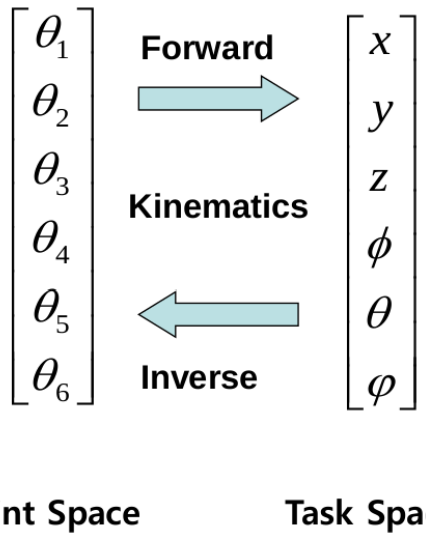
- **Kinematics**
  - The relationship between position, velocity, acceleration and time of the arm links.
  - The forces which cause motion are not included in kinematics.
- **Roles of kinematics in the robot arm**
  - The relationship between the end-effector pose(position, orientation) and the joint variables can be obtained by studying kinematics.
- **Joint space(관절 공간)**
  - Joint vector : a vector consisting of n joint variables of arm

$$q = \begin{bmatrix} q_1 \\ \vdots \\ q_n \end{bmatrix}, where\ q_i : joint\ variable(i = 1, ..., n)$$

  - Joint space : a space consisting of all joint vectors
- **Cartesian space (직교 공간) (or operational, task space)**
  - End- effector pose vector

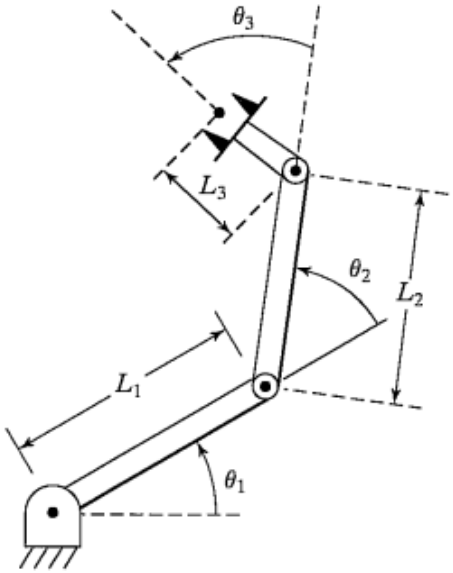
$x = \begin{bmatrix} P \\ - \\ \alpha \end{bmatrix} \in \Re^{m \times 1}$, where p : end-effector position & α : end-effector orientation

  - A space in which the end-effector pose is measured in the Cartesian coordinate system.



2-2. Forward kinematics

- **Joint space -> Cartesian space**



2-3. Inverse kinematics

- **Cartesian space -> Joint space**

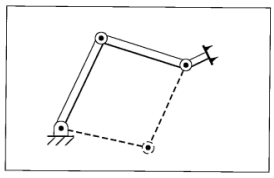


FIGURE 4.2: Three-link manipulator. Dashed lines indicate a second solution.

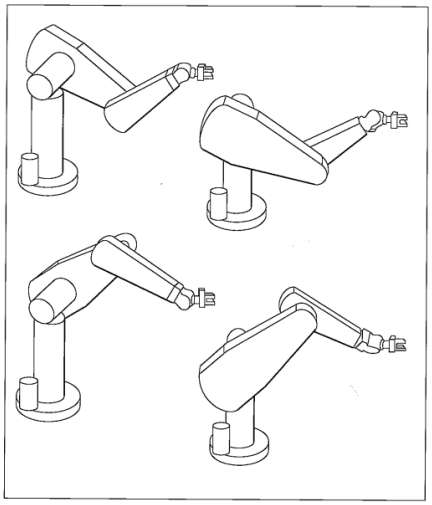


FIGURE 4.4: Four solutions of the PUMA 560.

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next 👉 jacobian matrix