III. Kinematic Diagram and D-H Frame

The Denavit-Hartenberg Notation, often known as D-H Notation, was developed in 1995 by Jacques Denavit and Richard Hartenberg to standardize coordinate frames for spatial links.

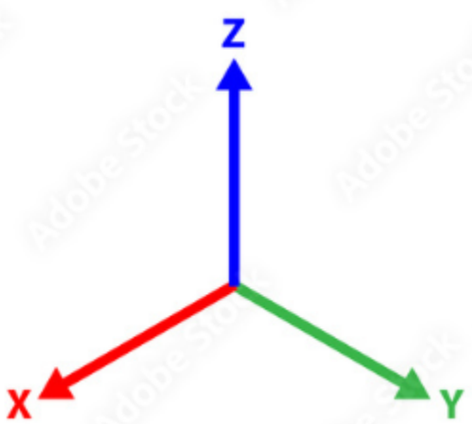
To solve the forward kinematics of a mechanical manipulator we will use the DH Notation (Denavit-Hartenberg Notation).

- The D-H notation offers a systematic approach to express the geometric configuration of robotic systems, making kinematic analysis and modeling easier.
- It is frequently used in robotics, particularly industrial robot systems and robot arms with manipulators.

In DH notation, there are some preliminary rules and main rules that define how to assign coordinate frames and determine the parameters for each joint.

D-H Frame Preliminary Rules

- Rule 1: Decide first the 3 views you want to project on your isometric drawing
- Rule 2: Identify the center of your frames
- Rule 3: Then draw your color coded arrows based on your decided 3 views.
    - Blue - z axis
    - Red - x axis
    - Green - y axis

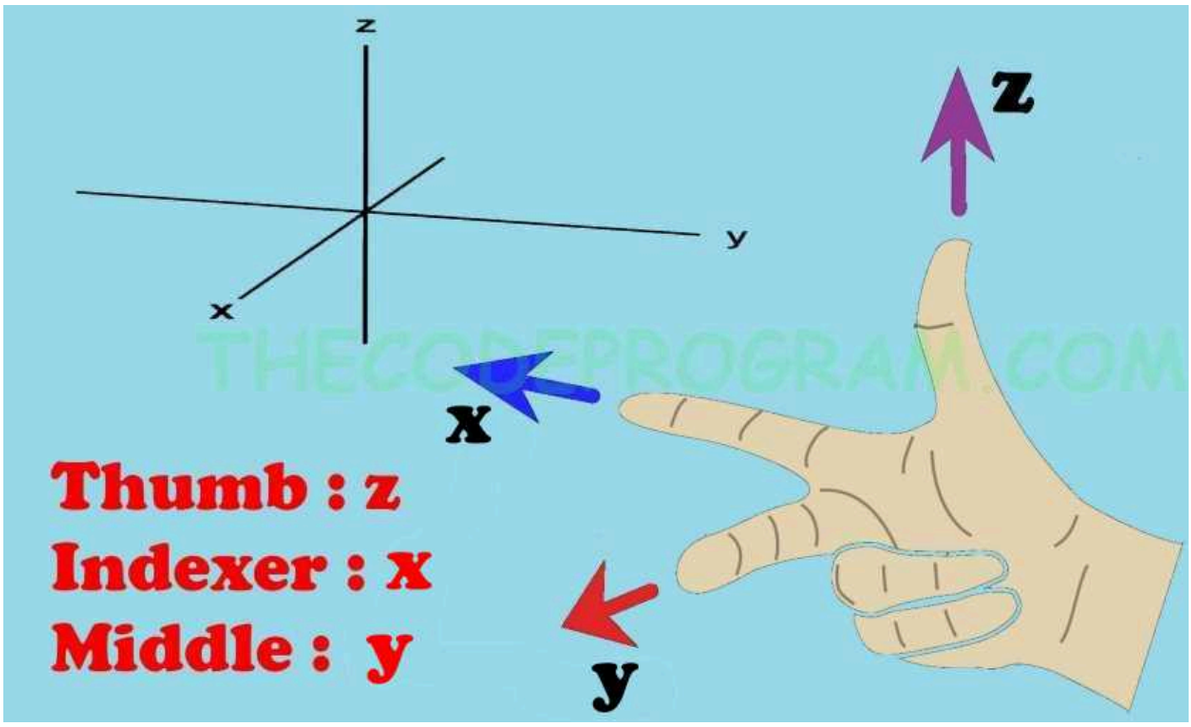


- Rule 4: Remember to make the arrows of Z and X axes easy to see for the future computations
    - Y axis less important than X and Z axes

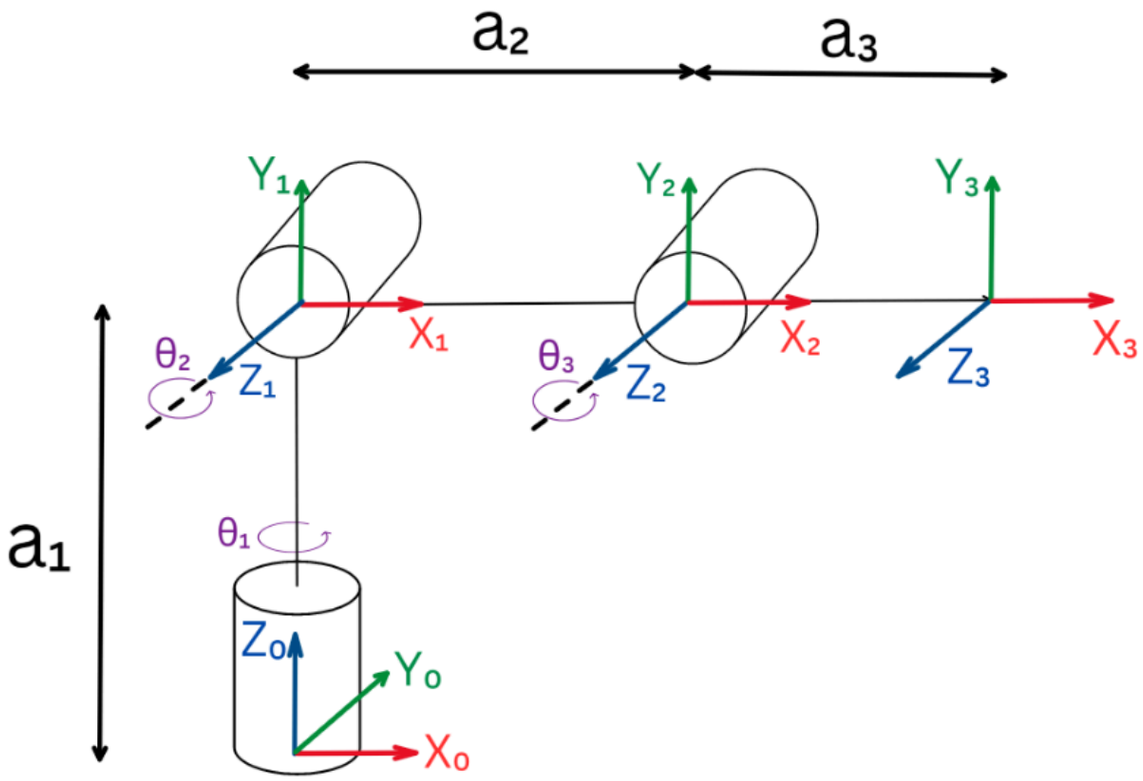
D-H Frame Rules

NOTE: THE COUNTING OF FRAMES STARTS FROM 0 (FROM THE FORMULA N-1)

- **Rule 1: The Z axis must be the axis of rotation for a revolute/twisting, or the direction of translation for a prismatic joint. (Labels starts from Z0)**
- **Rule 2: The X axis must be perpendicular both to its own Z axis, and the Z axis of the frame before it. (Labels starts from X0)**
- **Rule 3: Each X axis must intersect the Z axis of the frame before it. Rules for complying Rule 3:**
  - **Rotate the axis until it hits the other.**
  - **Or translate the axis until it hits the other.**
- **Rule 4: All frames must follow the right-hand rule (Labels starts from Y0**



Articulated Manipulator Kinematic Diagram and D-H Frame



Supplementary Video about the Kinematic Diagram and D-H Frame

To further understand how to get the Kinematic Diagram and D-H Frame, here is a supplementary video explaining how to get it.(https://drive.google.com/file/d/1CX_0pApp5kKIIYxm54IEQ58krmHvNwGa/view?usp=sharing)