Denavit and Hartenberg Method

Define:

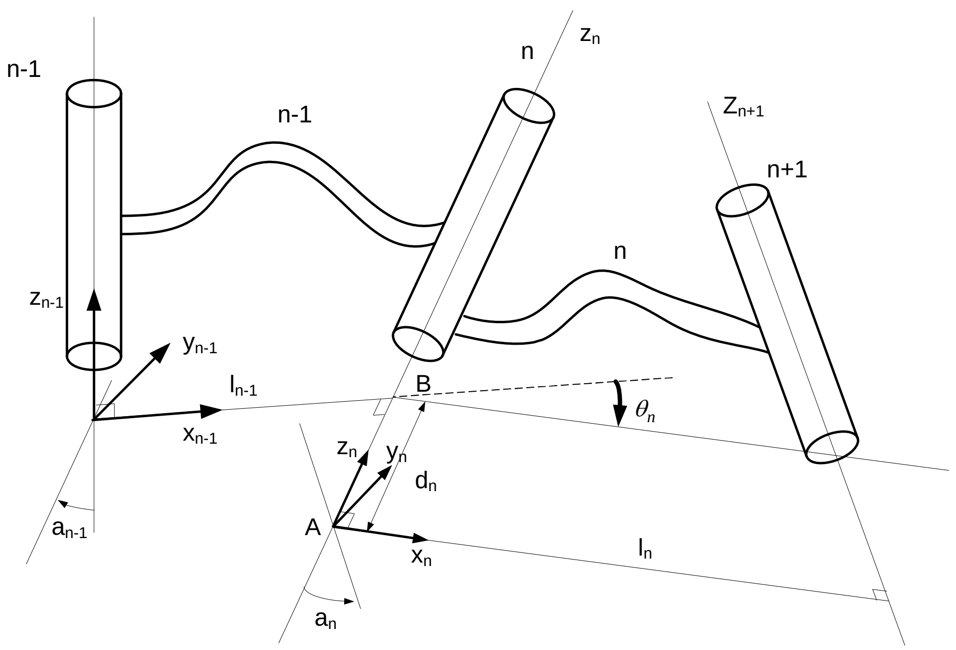
1. l_{n-1}: Link length: The distance from z_{n-1} to z_n measured along the x_{n-1} axis.
2. a_{n-1}: Link twist: The angle between z_{n-1} and z_n measured about the x_{n-1} axis.
3. d_n: Link offset: The distance from x_{n-1} to x_n measured along the z_n axis.
4. θ_n: Link angle: The angle between x_{n-1} and x_n measured about the z_n.

Rules:

1. Identify the joints (including their variables) and links (including the robot base). We start from n=1 for the robot base, i.e. reference frame n-1=0.
2. Identify the joint axes; assign the z axes such as they coincide with the joint axes.
3. Identify the common normal between z_{n-1} and z_n. At the point of the intersection of the common normal of n-1 and n, i.e. l_{n-1}, and joint axis n-1 assign the origin of frame {n-1}.
4. Assign the x_{n-1} axis to point along the common normal of n-1 and n.
5. Find the y_{n-1} by the right-hand rule.
6. Assign frame {0} in such a way that it coincides with {1} when the joint variable is zero.
7. Last frame (n):
   a. Prismatic: Assign x_n such as $\theta_n = 0$, and place the origin at the intersection of x_{n-1} and z_n when d_n=0.
   b. Revolute: Assign x_n such as x_n is parallel to x_{n-1} when $\theta_n = 0$, and place the origin such as d_n=0.

Special cases:

1. If the two joint axes (z_{n-1} and z_n) intersect, then the origin of {n-1} is located at the intersection and the x_{n-1} axis is orthogonal to the plane that the joint axes create.
2. If the two joint axes are parallel, then assign the origin in such a way that it is going to make d_n zero.



$$^{n-1}T_n = Rot(x, a_{n-1})Trans(l_{n-1}, 0, 0)Rot(z, \theta_n)Trans(0, 0, d_n) \text{ and } ^{R}T_H = {}^{0}T_1\, {}^{1}T_2\, {}^{2}T_3 \cdots {}^{n-1}T_H$$