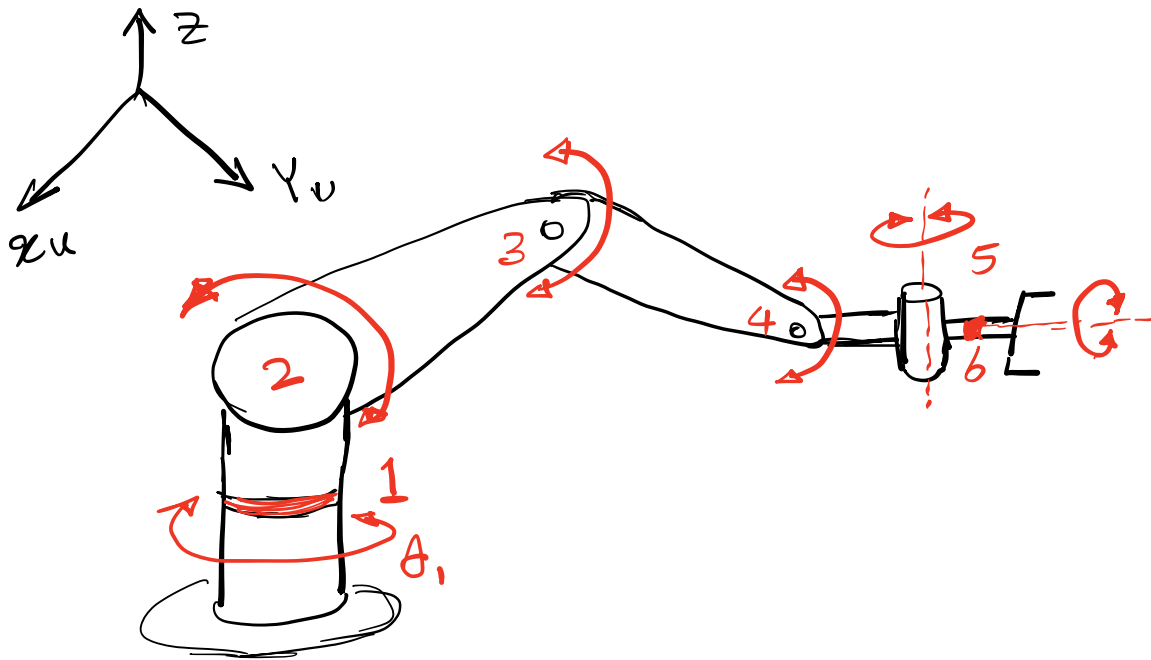
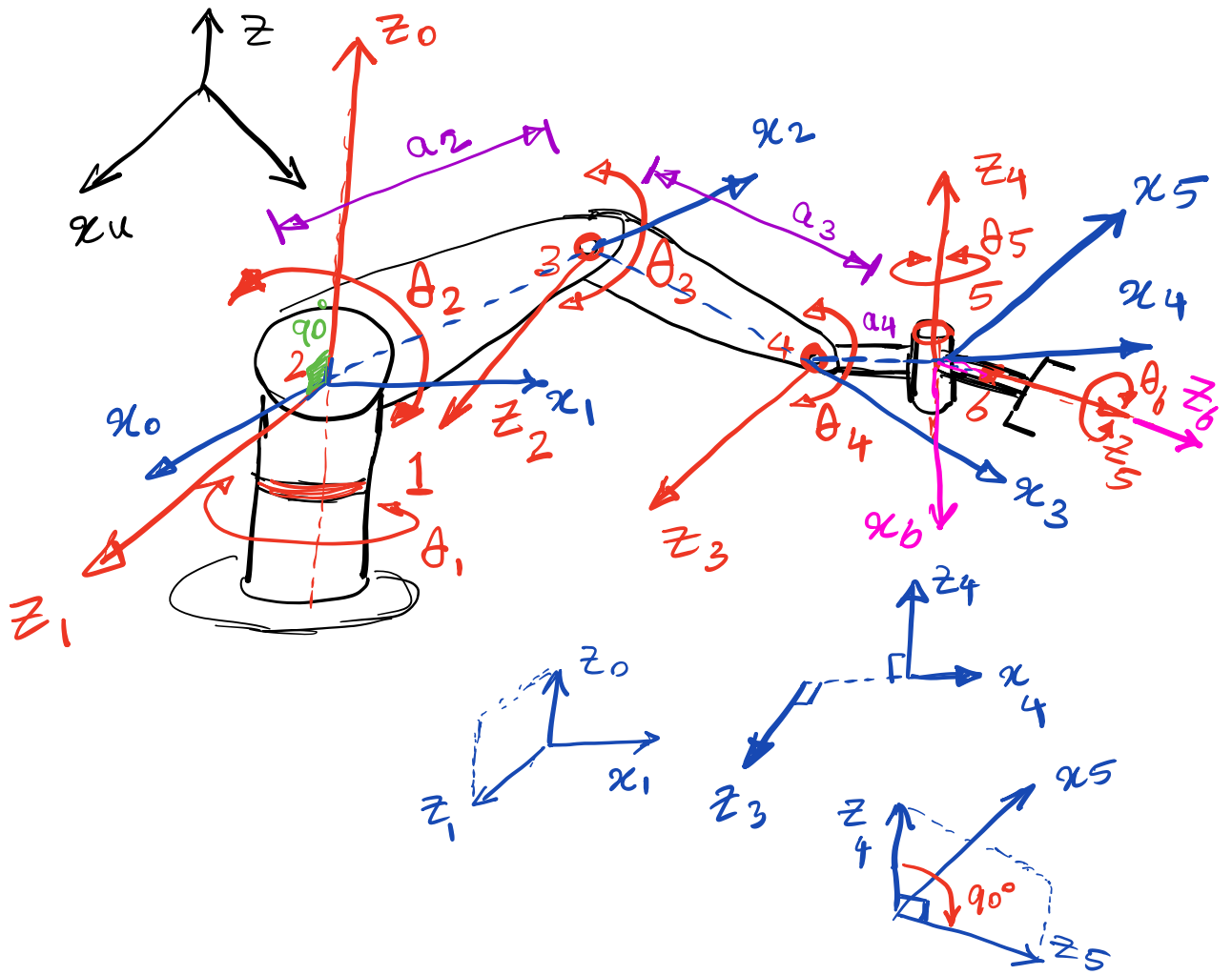


Example

For the simple 6-DOF robot in the figure, assign the necessary coordinate frames based on the D-H representation, fill out the accompanying parameters table, and derive the forward kinematic equation of the robot.





D-H parameters table

#	θ	d	a	α
	Rotate x_n to x_{n+1} about z_n by θ_{n+1}	Translate x_n to x_{n+1} along z_n by d_{n+1}	Translate z_n to z_{n+1} along x_{n+1} by a_{n+1}	Rotate z_n to z_{n+1} about x_{n+1} by α_{n+1}

0-1	Rotate x_0 to x_1 about z_0 by θ_1	Translate x_0 to x_1 along z_0 by 0	Translate z_0 to z_1 along x_1 by 0	Rotate z_0 to z_1 about x_1 by 90°
1-2	Rotate x_1 to x_2 about z_1 by θ_2	Translate x_1 to x_2 along z_1 by 0	Translate z_1 to z_2 along x_2 by a_2	Rotate z_1 to z_2 about x_2 by 0
2-3	Rotate x_2 to x_3 about z_2 by θ_3	Translate x_2 to x_3 along z_2 by 0	Translate z_2 to z_3 along x_3 by a_3	Rotate z_2 to z_3 about x_3 by 0
3-4	Rotate x_3 to x_4 about z_3 by θ_4	Translate x_3 to x_4 along z_3 by 0	Translate z_3 to z_4 along x_4 by a_4	Rotate z_3 to z_4 about x_4 by -90°

4-5	Rotate α_4 to α_5 about z_4 by θ_5	Translate α_4 to α_5 along z_4 by 0	Translate z_4 to z_5 along α_5 by 0	Rotate z_4 to z_5 about α_5 by 90°
5-6	Rotate α_5 to α_6 about z_5 by θ_6	Translate α_5 to α_6 along z_5 by 0	Translate z_5 to z_6 along α_6 by 0	Rotate z_5 to z_6 about α_6 by 0

Substitute the θ, d, a, α D-H parameters into the A matrices from the D-H Table use equation (2.53) for A matrix.

$$A_1 = \begin{bmatrix} c_1 & 0 & s_1 & 0 \\ s_1 & 0 & -c_1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$$A_2 = \dots A_3 = \dots A_4 = \dots A_5 = \dots A_6$$

see equation (2.57) page 84

in the book for the A matrices.

$$R T_H = A_1 A_2 A_3 A_4 A_5 A_6$$

The result is in equation (2.59)
