31383 ROBOTICS

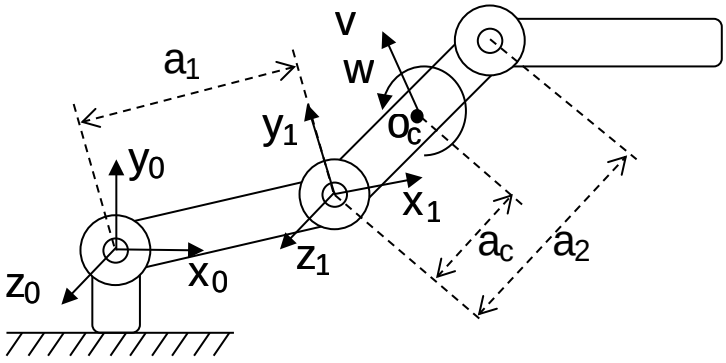
Exercise #3

Problem 1:
Two frames $O_0X_0Y_0Z_0$ and $O_1X_1Y_1Z_1$ are related by the homogeneous transformation

$$H = \begin{bmatrix} 0 & -1 & 0 & 1 \\ 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

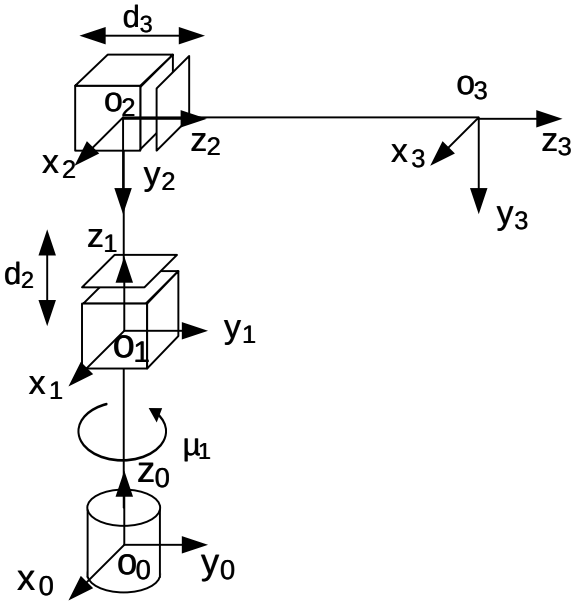
A particle has the velocity $\vec{v}_1(t) = \{3 \quad 1 \quad 0\}^T$ relative to frame $O_1X_1Y_1Z_1$. What is the velocity of the particle in frame $O_0X_0Y_0Z_0$?

Problem 2:

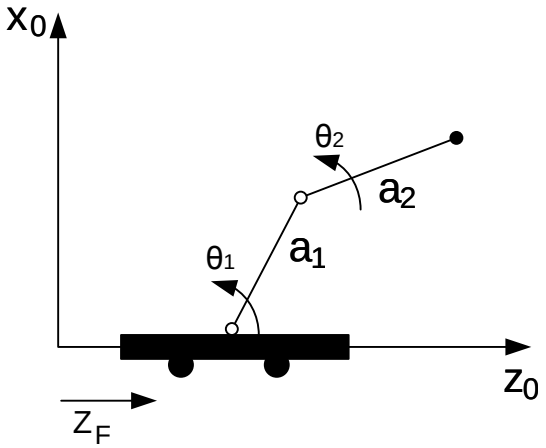


Consider the three-link planar manipulator show above. Compute the linear velocity $\vec{v}$ and angular velocity $\vec{\omega}$ of the center of link 2.

Problem 3:
Find the 6 × 3 Jacobian for the three links of the cylindrical manipulator shown below.



Problem 4:
A 2-link planar manipulator with a mobile platform moving in Z direction is shown below. The robot works only in the $X - Z$ plane in the working space.



Determine the transformation matrix T_3^0, and find the Jacobian matrix for this mobile robot.