

## Assignment 2

- 1) Figure 1 shows two systems that we will consider. In each system, Frame 1 represents the inertial reference frame that we will describe everything with respect to. In the first system, a prismatic joint moves Frame 2 parallel to the  $z_1$  axis. In the second system, a rotational joint rotates Frame 2 about an axis parallel to the  $x_1$  axis. The figure is drawn with right angles, and lengths are clearly marked. For each system, do the following:
- Give the homogeneous transformation  $g_{12}(0)$ , which relates Frame 2 to Frame 1 when  $\theta = 0$ , as it is shown in the figure.
  - Give the screw parameters that geometrically describe the screw motion of the joint with respect to Frame 1.
  - Express the geometric “screw” in its abstract mathematical “twist” notation.
  - Find the homogeneous transformations that describe Frame 2 with respect to Frame 1 for each case, for an arbitrary  $\theta$ .
  - Rigidly assign three points to Frame 2:  $[1 \ 0 \ 0]$ ,  $[0 \ 1 \ 0]$ ,  $[0 \ 0 \ 1]$ . These points are all defined with respect to Frame 2. Move the joint  $\theta$  through the values  $\theta = [0, 4]$  for the prismatic joint and  $\theta = [0, \pi/2]$  for the rotational joint. Use MATLAB to plot the  $(x, y, z)$  position of these three points with respect to Frame 1. Include three plots:  $x$  vs  $\theta$ ,  $y$  vs  $\theta$ , and  $z$  vs  $\theta$ . Each of the three plots should include three lines (one for each of the points). Include a fourth 3-D plot showing the three paths taken by the points. Make sure the plots are well labeled.

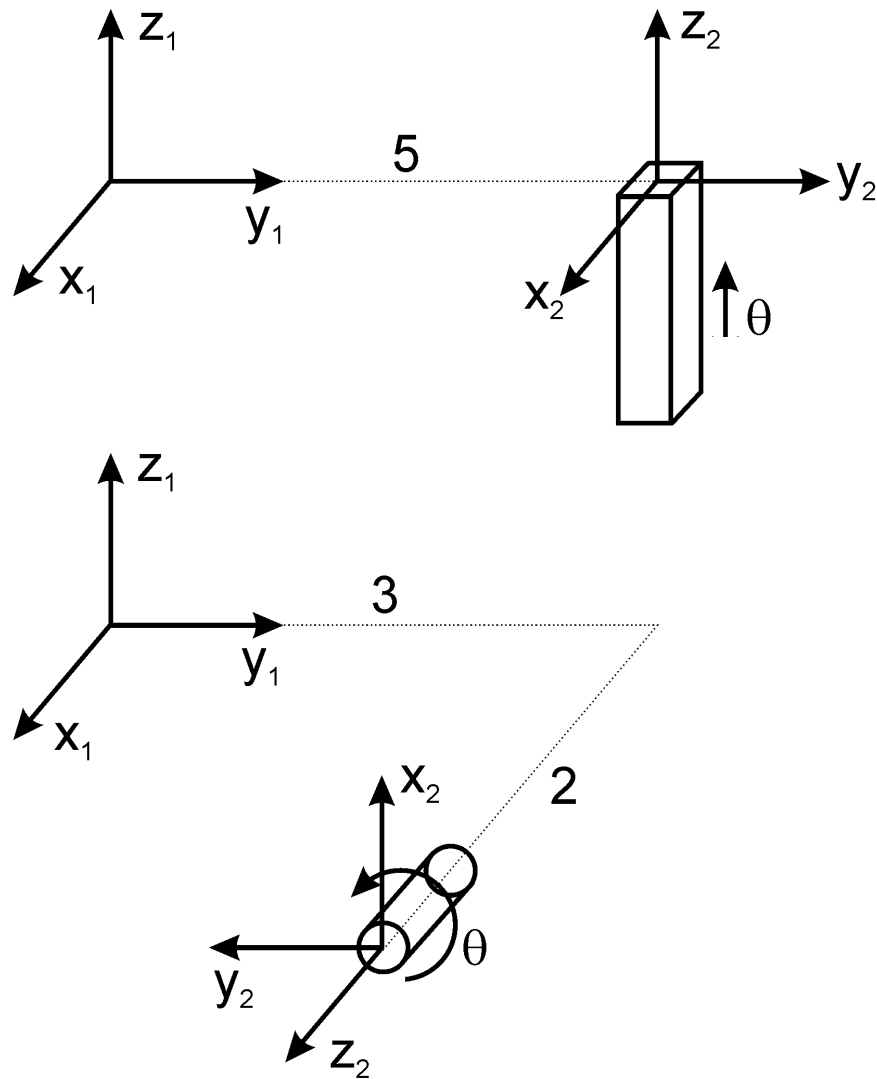


Figure 1