

**Mechanical and Aerospace Engineering Department**  
**University of Texas at Arlington**  
**Introduction to Robotics - ME 5337**  
**Homework # 2**

**Due Date: Third class meeting from day of assignment**

**Textbook Problems**

- 2.1
- 2.5
- 2.12
- 2.13
- 2.27 through 2.34

**Problem 2.18 (Spong and Vidyasagar)**

Consider the diagram of the following Figure. A robot is set up 1 meter from a table, two of whose legs are on the  $y_0$  axis as shown. The tabletop is 1 meter high and 1 meter square. A frame  $o_1 x_1 y_1 z_1$  is fixed to the edge of the table as shown. A cube measuring 20 cm on a side is placed in the center of the table with frame  $o_2 x_2 y_2 z_2$  established at the center of the cube as shown. A camera is situated directly above the center of the block 2m above the tabletop with frame  $o_3 x_3 y_3 z_3$  attached as shown. Find the homogenous transformations relating each of these frames to the base frame  $o_0 x_0 y_0 z_0$ . Find the homogeneous transformation relating the frame  $o_2 x_2 y_2 z_2$  to the camera frame  $o_3 x_3 y_3 z_3$ .

**Problem 2.19**

In Problem 2-18, suppose that, after the camera is calibrated, it is rotated  $90^\circ$  about the axis  $z_3$  to  $o_3 X_3 Y_3 Z_3$ . Re-compute the above coordinate transformations.

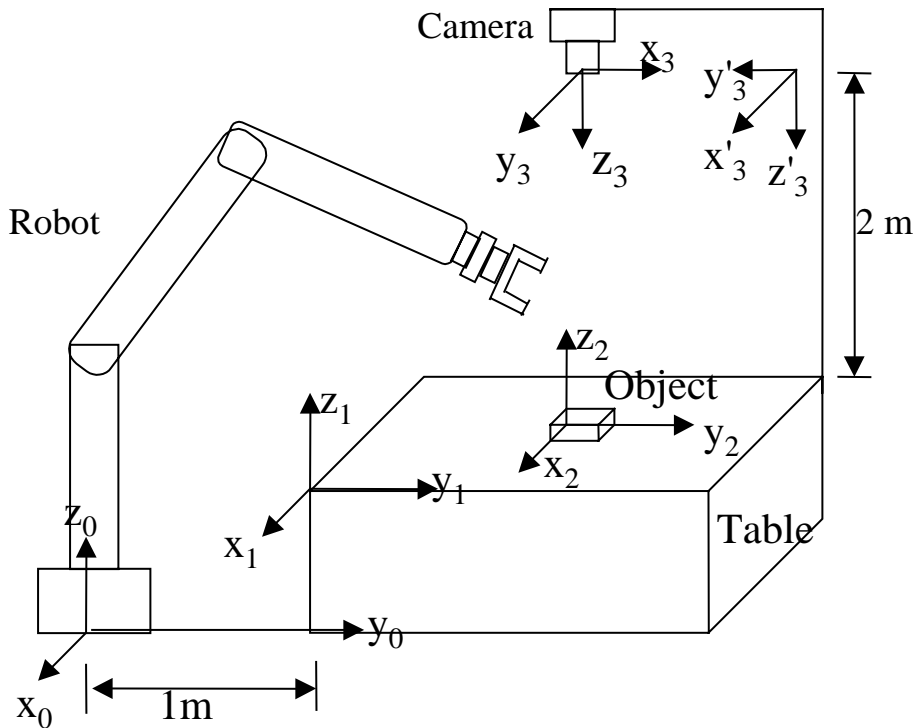


FIGURE 2-11