IMSE/CIS 381 Industrial Robotics
Lab Manual

Lab 1   Program creating and Frame Setup

1. OBJECTIVES

The objective of this experiment is to let students have hands-on experience on fanuc robot operating and have basic knowledge of how to use the teach pendant. Also, students will have basic concepts of tool frame as well as user frame and know how to use each frame for a specific purpose.

2. INSTRUMENT SET-UP

Fanuc robot LR Mate 200iD, Fanuc robot M-1iA

3. CONTENT TASKS

• Power up and jog the robot in Joint/World.
• Tool frame, user frame setup.
• Create a Program (Optional)

4. OPERATION PROCEDURES

Condition:
• ***All personnel and unnecessary equipment are out of the workcell.***
• The mode select switch is in the T1 position.
• Fault lights are not illuminated.

Power up the robot by turning on the circuit breaker on the robot controller.

Create a Program

1. Name the program:
    a Turn the teach pendant ON/OFF switch to ON.
    b Press SELECT .
    c If F2, CREATE, is not displayed, press NEXT. Press F2, CREATE. You will see a screen similar to the following.

```
1 Words
2 Upper Case
3 Lower Case
4 Options                          Insert -

--- Create Teach Pendant Program -

Program name [

                              -- End -
Enter program name
```

    d Move the cursor to a method of naming the program. The function key

labels will change depending on the naming method you choose.

    e Type the program name: BOX

Press the function keys whose labels correspond to the name you want to give to the program. These labels vary depending on the naming method you chose in Step e. For example, if you chose Upper Case, press a function key corresponding to the first letter. Press that key until the letter you want is displayed in the program name field.

Press the right arrow key to move the cursor to the next space. Continue until the entire program name is displayed.

NOTE: You can also use the numbers on the teach pendant to include numbers in your program name, but you cannot start a program name with a number.

To delete a character to the left of the cursor, press BACKSPACE.

To delete a character under the cursor, press SHIFT and the right arrow key.

When you are finished, press ENTER .You will see a screen similar to the following.

```
1 Words
2 Upper Case
3 Lower Case
4 Options                              Insert -

--- Create Teach Pendant Program -

Program name [TEST111]

                              -- End -
Select function
```
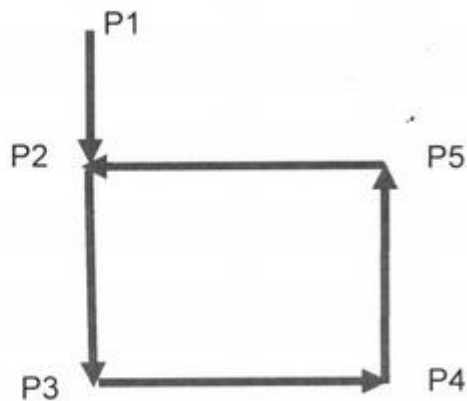
2. Teach a simple Handling Tool path that begins from Start position and can return back to the Start position without colliding with any object. Use default motion instructions.

BOX:

1: J P[1] 100% FINE

2: J P[2] 100% FINE

3: J P[3] 100% FINE

4: J P[4] 100% FINE

5: J P[5] 100% FINE

6: J P[2] 100% FINE

7: J P[1] 100% FINE

END

Define a Tool frame

1. Press 'MENU' and then select setup.
2. Press 'F1' and select Frames.
3. Press 'F2' and select a frame. Press 'F3' and type the desired frame number. Press 'ENTER' and then 'F2'. Choose 'Three point method'.
4. Select Three Point. You will see a screen similar to the following.

```
SETUP frames
  Tool frame Setup / Three Point
  frame Number: 1
    X:   0.0      Y:   0.0       Z:    0.0
    W:   0.0      P:   0.0       R:    0.0
  Comment: ******************

  Approach point 1:       UNINIT
  Approach point 2:       UNINIT
. Approach point 3:       UNINIT

  Active TOOL $MNUTOOLNUM[1j=1
```

5. To add a comment:
  a Move the cursor to the comment line and press ENTER .
  b Select a method of naming the comment.
  c Press the appropriate softkeys keys to enter the comment.
  d When you are finished, press ENTER .
NOTE: Record the three approach points with the tool tip touching the same point from three different approach directions.
6. Record the first approach point:
  a Move the cursor to Approach point 1.
  b Jog the robot so that the tool tip touches a reference point.

c Press and hold the SHIFT key and press F5, RECORD.

7. Record the second approach point:

   a Move the cursor to Approach point 2.

   b Rotate the faceplate about the axis of the World coordinates. Large rotations, near 90°, give the best results. However, smaller rotations can be used if motion is restricted by cabling or other attachments.

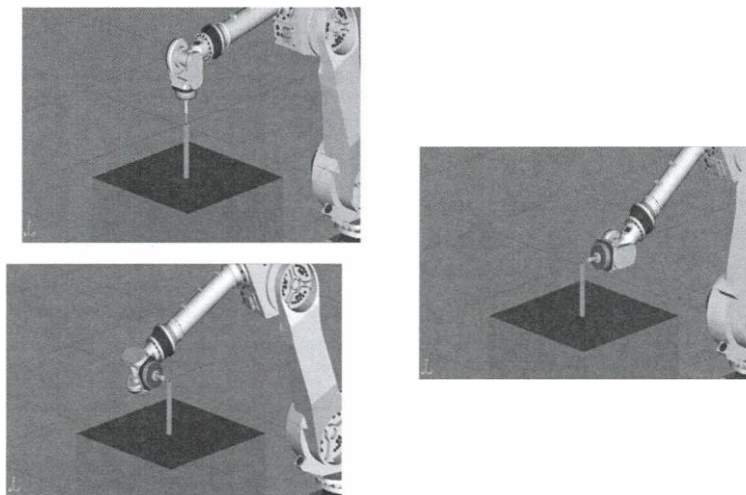   c Jog the robot so that the tool tip touches the reference point.

Figure 1 Setup a tool frame using 3 point method

   d Press and hold the SHIFT key and press F5, RECORD.

8. Record the third approach point:

   a Move the cursor to Approach point 3.

   b Rotate the tool about either the X, Y or Z axis of the World coordinates. The three approach point angles must converge on the same point in space, the reference point. The angles must not be 1800 apart or in the same plane.

   c Jog the robot so that the tool tip touches the reference point.

   d Press and hold the SHIFT key and press F5,RECORD. You have finished the tool frame.

9. Use the Jog Menu. Press and hold SHIFT and press COORD ,move the cursor to Tool, and type the number of the frame you want to use. Press COORD and select TOOL as the jog method. Jog the robot in the frame you just taught. If the TCP is correct, it will remain stationary during rotational moves W, P, R.

10. To move to a recorded position, move the cursor to the desired position, press and hold the SHIFT key and press F4, MOVE_TO.

CAUTION

When you are finished setting the frame configuration, save the information to

the default device (generate a directory of FRAMEVAR.SV) so that you can reload the configuration data if necessary. Otherwise, if the configuration is altered, you will have no record of it. If the TCP is not correct, it will not remain stationary during rotational moves-You need to review your recorded positions.' If they are not correct, re-record them correctly.

WARNING
When you use F4, MOVE_TO, to move the robot, unexpected motion can occur. This could injure personnel or damage equipment. Use a slow speed and make sure the robot is clear of obstacles.

Define a User frame

WARNING
If you set up a new frame, make sure that all frame data is zero or uninitialized before you record any positions. Press [F4], CLEAR, to clear frame data. If you modify an existing frame, make sure that all frame data is set the way you want before you change it. Otherwise, you could injure personnel or damage equipment.

1. Press MENU .
2. Select SETUP.
3. Press F2, TYPE.
4. Select Frames.
5. If user frames are not displayed, press F3 , OTHER, and select User. If F3, OTHER, is not displayed, press PREV
6. To display the settings for all frames, press PREV repeatedly until you see a screen similar to the following.

```
SETUP Frames
   User/RTCP Setup /                                    Three Point
                             X          Y          Z        Comment
                    1:      0.0        0.0        0.0  **************
                    2:      0.0        0.0.       0.0  *************
                    3:      0.0        0.0        0.0  *************
                    4:      0.0        0.0        0.0  *************
                    5:      0.0        0.0        0.0  *************
                    6:      0.0        0.0        0.0  *************
                    7:      0.0        0.0        0.0  *************  .~
                    8:      0.0        0.0        0.0  *************
                    9:      0.0        0.0        0.0  *************
                  Active UFRAME/RTCP    $MNUFRAMNUM[1]=0
```

7. To set the numerical values to zero, move the cursor to the frame number, press F4 , CLEAR, and then press F4 , YES, to confirm.
8. Press F2, DETAIL.
9. Press F2, METHOD.
10. Select Three Point. You will see a screen similar to the following.

```
SETUP Frames
   User/RTCP Setup/ Three Point
   Frame Number: 2

    X: 0.0            Y:    0.0      Z:    0.0
    W: 0.0            P:    0.0      R:    0.0


  Comment: *****************
  Orient Origin Point:          UNINIT
  X Direction Point:            UNINIT
  Y Direction Point:            UNINIT

  Active UFRAME/RTCP $MNUFRAMNUM[1]=1
```

11. To add a comment:
    a Move the cursor to the comment line and press ENTER.
    b Select a method of naming the comment.
    c Press the appropriate function keys to enter the comment.
    d When you are finished, press ENTER.
12. Define the origin point of the user frame: (Orient Origin Point)
    a Move the cursor to Orient Origin Point.
    b Jog the robot TCP to the origin. Figure defining the Origin, the origin is labeled number 1.
    c Press and hold the SHIFT key and press F5, RECORD.
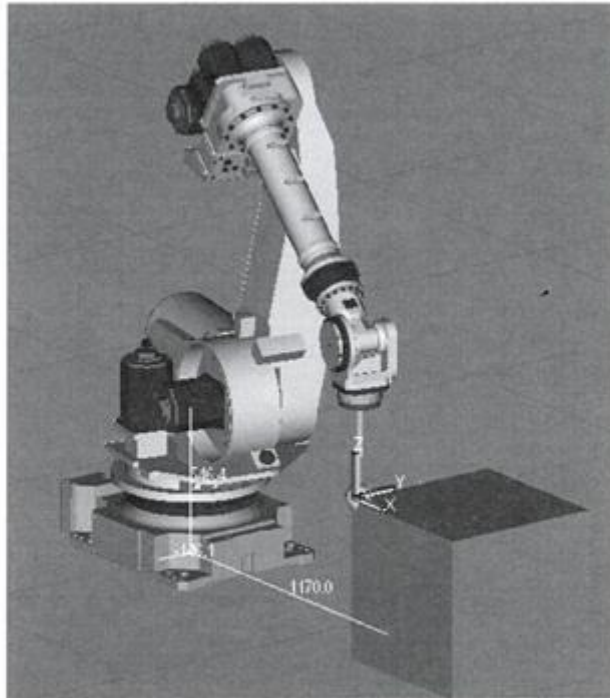
Figure 2 Define the origin of user frame

13. Define the X/J1 direction point (X Direction Point) :

a Move the cursor to X Direction Point.

b Jog the robot tool tip along the x-axis. In Figure. Defining the X Direction Point this point is labeled number 2.

c Press and hold the SHIFT key and press F5, RECORD.

14. Define a point on the positive X-Y plane (Y Direction Point)

a Move the cursor to Y Direction Point.

b Jog the robot to a location on the positive X-Y plane. In Figure. Defining
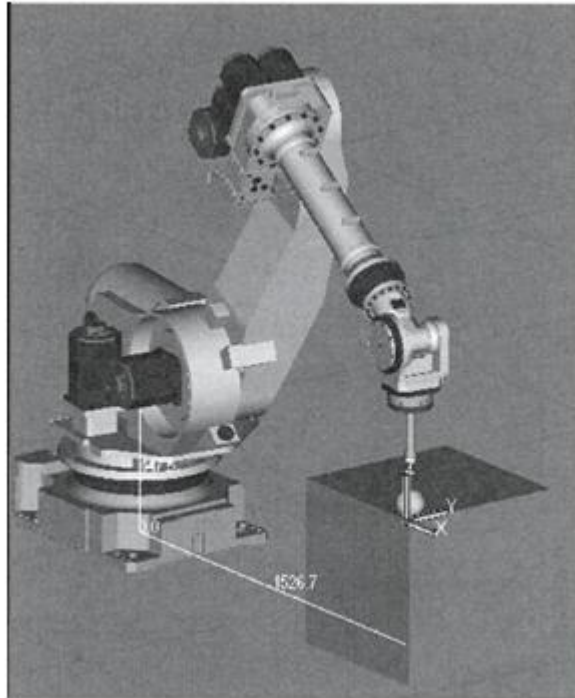
Figure 3 Define the X direction

the X-Y Plane, this point is labeled number 3.

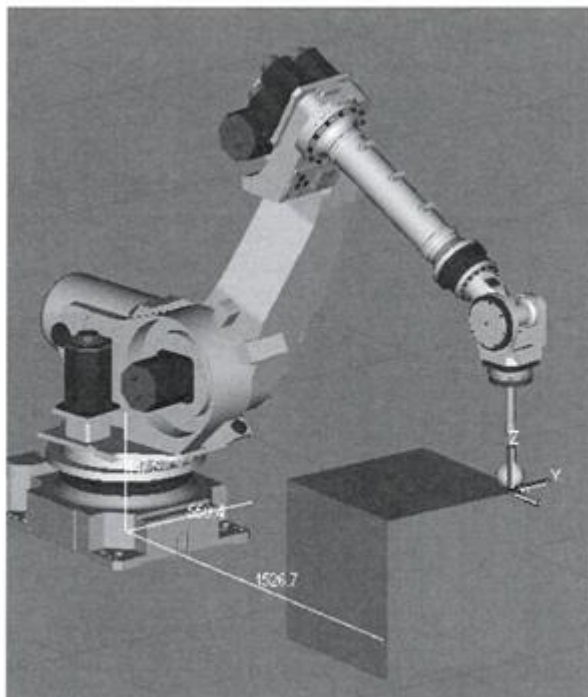   c Press and hold the SHIFT key and press F5, RECORD.

Figure 4 Define the Y direction

15. Use the Jog Menu. Press and hold SHIFT and press COORD, move the cursor to User, and type the number of the frame you want to use.

16. Jog the robot in the +x, +y, and +z directions. The robot should move in the

correct directions according to the frame you defined.

CAUTION
When you are finished setting the frame configuration, save the information to the default device so that you can reload the configuration data if necessary. Otherwise, if the configuration is altered, you will have no record of it.

17.To move to a recorded position, move the cursor to the desired position, press and hold the SHIFT key and press F4, MOVE TO.

WARNING
When you use F4 , MOVE_TO, to move the robot, unexpected motion can occur. This could injure personnel or damage equipment. Use a slow speed and make sure the robot is clear of any obstacles.