Control of industrial robots
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Programming an industrial robot in a virtual environment

This lab session requires RobotStudio 7.x (licensed version) and RobotWare 6.09

With this lab session we will learn first steps in the use of the virtual programming environment ABB RobotStudio following the basic tutorials of the product.

In particular we will learn how to:

- Create a new robot system
- Jog the robot
- Import a tool
- Create a path and move along the path
- Import a geometry
- Create a program and synchronize it to the virtual controller

How to proceed

1. Open RobotStudio and create a new solution with an empty station
2. From the ABB library select the IRB140 robot
3. Practice with the ways to change the view of the scene (zoom, rotate, pan, view all)
   - **Zoom**: to see details of the station
   - **Rotate**: to turn around the robot and see it from different perspectives
4. Under the Home tab, from the menu “Virtual Controller/From Layout” import a robot virtual controller. Give it a name and press “finish”. This virtual system replicates exactly the software used by the real robot controller. Hence the robot simulated in RobotStudio behaves like it would in the real station.

5. Practice with jogging the robot in joint or in Cartesian space using the buttons in the “Freehands” toolbar. Alternatively, you can select the robot in the Layout window, click the “Modify” tab and, in the “Motion” menu, click “Mechanism Joint Jog”: this time you can use the sliders to move each single joint. It is also possible to type the desired joint values.

6. From the tab “Home” select the menu “Import Library”: choose a tool (“My tool”) from the “Equipment/Training objects” library

7. Attach the tool to the robot end-effector by dragging and dropping it to the robot in the Layout browser

8. Create an empty path (menu “path”). A path in RobotStudio is intended to be a holder for motion instructions.

9. Modify the motion instruction template: change the velocity to v500 and the zone to z10 (with the menus in the bottom toolbar)
10. From the Home tab, use the button “Teach instruction” to select some poses of the robot (jog the robot manually in joint or linear mode). Below Path_10 you will see the list of the motion instructions just set.

11. Let the robot move along the path (right click on Path_10 and select “Move along the path”). RobotStudio will synchronize the path with instructions to the system and it will start moving the robot.

12. Delete the path: select Path_10 then click on the Modify tab and click “Delete”. This will delete the path and the motion instructions just created.

13. Delete the target positions: mark T_ROB1 and click the Modify tab, then click “Remove unused targets”

14. From the Home tab under the “Import Library” Menu, select “Equipment/Training objects” library and choose the “propeller table”

15. Select the table in the Layout browser and then, in the menu Modify, choose the button “Set Position” to set its position XYZ as (400, -200, 0) in mm in the World frame.

16. Create a new work-object (From the tab “Home” from the menu “Other”, click “Create Workobject”)

17. Below “User Frame” select “Frame by points” and then “Three points” method

18. Click the icon “Surface selection” and then “Snap edge” mode.

19. Activate the first input window of the Three-points window. Select three points on the surface of the object fixed to the table, then “Accept”, “Create”. We now have the new workobject in the corner of the table.
20. Select “Create target” from the menu “Target” under the Home tab.

21. Change to “Snap object” mode

22. Activate the input window. In the graphics window select a few points. Then, click “Create” and “Close”.

23. Right-click on “Target_10”

Then select “View tool at target” and “MyTool”: a representation of the tool at the target position and orientation will be shown. You will see the tool under the table.
24. Right-click “Target_10”. Select “Modify target/Rotate” and rotate the target 180° around the y axis. Press “Apply”. The tool appears in the correct position and orientation. Then click “Close”.

25. Right-click “Target_10” and select “Copy orientation”. Select all the remaining targets, right-click and select “Apply orientation”.

26. Deselect the option “View tool at target” by unchecking “MyTool”.

27. Change the velocity to v50 and the zone to fine.

28. Select all the targets, right-click and select “Add to new path”. Path_10 is created with the instructions set from the instruction template.

29. Edit the first move instruction to change it to a MoveJ (Right-click the first instruction and press “Edit instruction”. Then change motion type to “Joint”). It is easier for the robot to execute the first instruction as a MOVEJ. Press “Apply”, then “Close”.

30. Right click on Path_10 and then “Auto Configuration”: this calculates the configurations for all the target positions of the path. Select one of such configurations.

31. Press the button “Path” and create an empty path. Then rename it as “main”. Main represents the entry point when running a robot program.

32. Right click main and insert procedure call Path_10.

33. Click “Synchronize/Synchronize to Rapid” to synchronize the object created in the station with the RAPID code. Select also “Path_10” then click OK.

34. Select the tab RAPID, then expand RAPID/T_ROB1 and double-click module 1: the robot program will show up. It can be saved and loaded to the real robot.

35. To run the simulation in RobotStudio, click on the Simulation tab.

36. Press Play to run the simulation.

37. Save the station.