# UNIVERSITY OF VICTORIA

Department of Electrical and Computer Engineering
**ELEC 360 – Control Systems I**

## Laboratory

Experiment no.: 4

Title: Introduction to the Programming of a Robot Arm

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# 1.0 Summary

The lab “Introduction to the Programming of a Robot Arm” uses a hand held controller and a desktop software to control and interact with a robot arm to examine the ways in which a robot arm moves. With the tools available, the experimenters will gain a better understanding of what positioning constraints must be considered when assigning simple movements to a robot arm. There is no quantifiable data collected within this lab as it is simply an introductory lab.

# 2.0 Introduction

The objective of this lab is to become familiar with programming a robot arm to perform simple tasks. Using both the hand-held controls and the Robotics software on the lab computer, the set of simple tasks were accomplished.

# 3.0 Answers to the Pre-laboratory Assignments

Describe briefly the difference between Angular and Linear modes.

**Linear** - All servos are activated and the arm position is treated as though on an XYZ plane based on an initial point of reference.

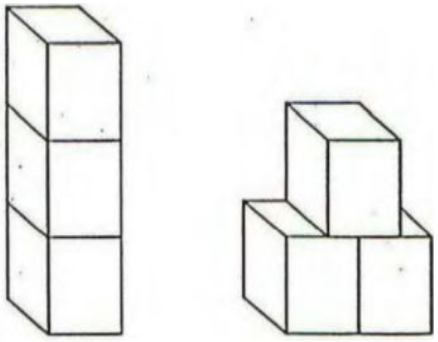
**Angular** - Only individual servos are activated to complete a motion. Much more time consuming but accurate to complete a series of movements.

What is the Hard Home position and why is it being used.

The hard home position is used to do a full reset of all reference values for the robotic arm. If a hard reset is done prior to each move, it almost guarantees that the series of actions following will be consistent.

# 4.0 Experimental Results

The following figure is a screenshot of the finished set of moves that were programmed into the desktop software to accomplish a task. The task was to take 3 wooden cubes stacked on top of each other and move them to the other side of the table stacked in a pyramid shape.



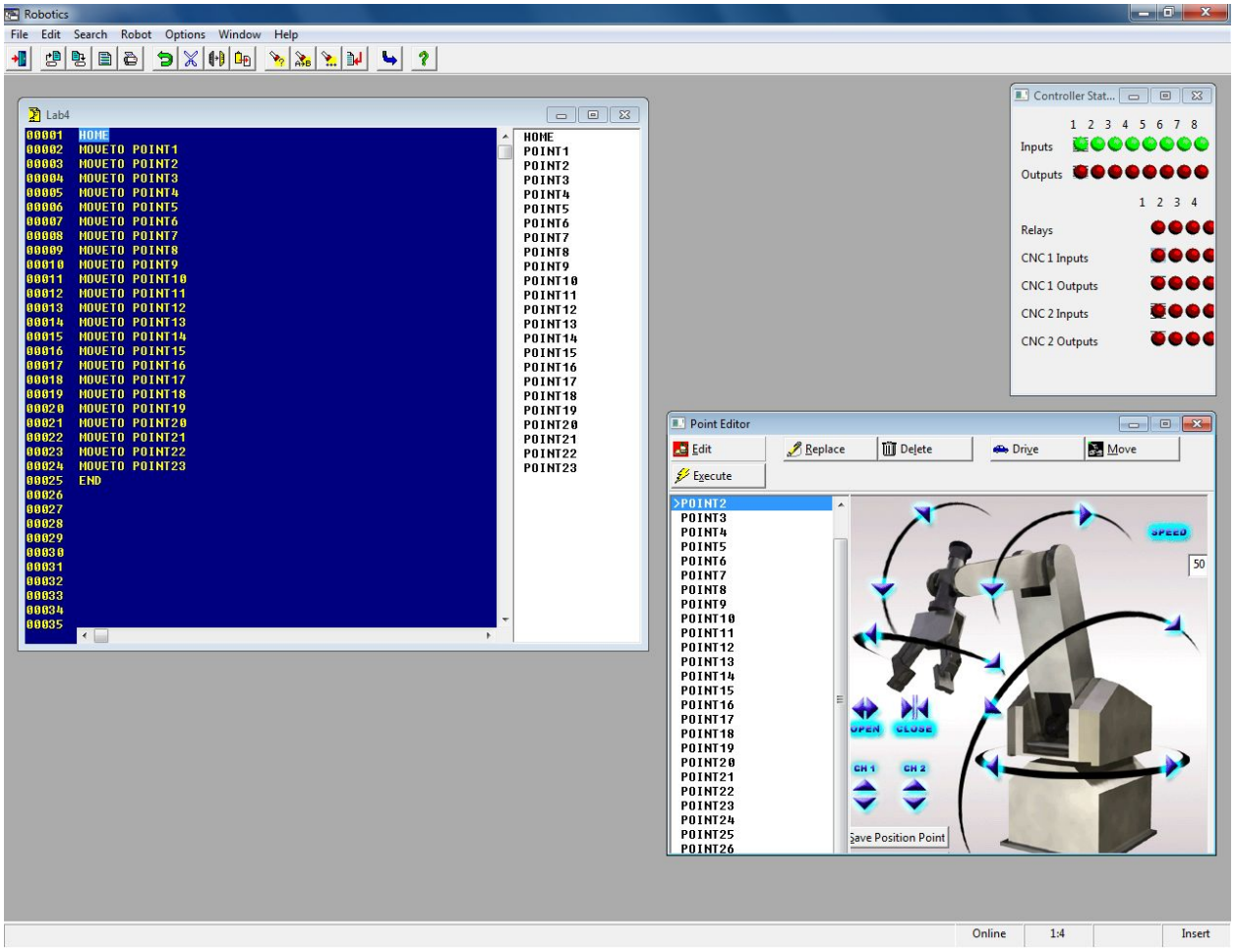



Figure 1: Experimental results from running the robot from the PC

# 5.0 Discussion

The Hand-Held Terminal was activated, and was programmed for the ‘Teach’ mode. At first, ‘L’ was selected for the Linear mode for the maneuver. Each point for in the set of desirable position for lifting the blocks were saved using the ‘.’ command, and  the points were re-traced. Similar steps were done for the maneuver with the Angular mode. Both the steps have been successfully done, and checked by the TA.

The PC mode required running an application named ‘Robotics’ on the computer. The robot was given various positions to program a task. From the Point Editor window, the joints were moved and the desired positions were saved. The list of the saved points were run by clicking on the ‘Execute’ and was verified by the TA for the successful result. From the saved points in the Point Editor, the Task Editor was used to copy the desired points from the Point Editor to the Task Editor. The task was run by the ‘run’ button and was verified by the TA for the successful results.

# 6.0 Conclusions

The hand controls were easier to use as it gave a more tactile feel compared to the buttons on the desktop computer.  The desktop computer was much better for diagnosing errors in the robot arm’s movement sequence.  For both interfaces, the speed was lowered during the arm movement and increased greatly during the phase where the grabber is functioning because the servos in the robot’s hand moved very slow.