

MTRN4230 Lab 02

1. Aim

Lab 2 aims to familiarise yourself with some advanced features of PolyScope programming. You will focus on the use the [palletising template](#) to define [a series of steps](#) that outline a stacking or unstacking procedure of objects. This type of operation is commonplace in industry such as production lines, where humans and robots are likely to work together collaboratively.

You will also be completing the demonstration component of the ROBOT-1 assessment task, if you have not already completed it in lab 1.

2. Pre-lab

You must have completed the necessary pre-demonstration components for the ROBOT-1 assessment, as outlined in the ROBOT-1 Assessment on Moodle.

Pre-lab checklist:

- Complete all “Prior to Lab Demonstration” tasks for the ROBOT-1 assessment.
- Attempt Modules 9-11 of the [e-Series Pro Track](#).
- Attempt Module 12 (Palletising) of the [e-Series Application Track](#).
- Bring a USB-C to USB-A adapter if your computer needs it. This is for transferring your programs from your computer to the robot. One USB drive per robot is provided in the lab
- Highly Recommended Optional Tasks:
 - Read through the ROBOT-2 assessment
 - Watch the tutorial videos released on how to use the RTDE toolbox for ROBOT-2. The video covers how to use the toolbox to draw the digit 1. It also covers how to achieve arbitrary translation and rotation.
 - Have an attempt at starting to implement the ROBOT-2 assessment at home

3. Lab Activities

During the lab you should complete the palletising tasks below. Once you have completed your ROBOT-1 Assessment, you may be able to test out your program on the UR5e in the Lab.

3.1. Assessed Tasks (ROBOT-1 Assessment – Demonstration)

Complete the ROBOT-1 In-Lab Demonstration in person during your scheduled lab time

3.2. Lab Work Tasks

Simple shapes with URsim

Write the following programs on Polyscope on the URsim, transfer them to the UR5e with a USB and run the programs. Note, the Lbuntu Ursim image is very old, this means that USB3.0 devices will not be recognised. Please use USB2.0 devices.

1. Use Polyscope to draw a square of size 100 mm with movej and movel.
2. Use polyscope to draw a circle with radius of 100 mm with movec (Circle Move).

Palletising task

(i) Set up the tool:

- We will assume the end effector is a simple thin stick that is 100mm long and weighs 50g (this will not actually be picking up any objects).
- The tool will protrude outwards (along the Z-axis) from the centre of the tool mounting plate.
- Add a new TCP for this tool.
 - Refer to the user manual and 'Module 3. Setting up a Tool' from the e-Series Core Track if you require a refresher on how to do this.
 - Remember to account for the weight of the tool when setting the payload.

(ii) Make a new program and add a 'Palletise' template to the program.

(iii) Referring to Module 12 Palletising from the e-Series Application Track, set up the components of the Palletising template as:

- Pick a grid pattern layout with 3 rows and 2 columns.
- Choose an object height of 30mm.
- Define the 4 corners of the pallet grid by moving the robot into each of the desired positions. Define the 'At each item' waypoints. (For tool action, you may select 'No Action'.

(iv) Set up a source location for the objects:

- Above the pallet template program insert 3 new moves, which will represent the location where the robot picks up the objects from:
 - The first waypoint indicates the position above the object to pick up.
 - The second waypoint indicates the position when moved down and touching the object.
 - The third waypoint indicates the position after it has lifted the object up.
- These waypoints simulate where the robot would need to collect each object from to begin with, such as from a conveyor belt.

(v) Once the above is completed, you may add in additional layers, separators, or change from grid to irregular pallet layouts

4. Post-lab

- Practice implementing tasks in URSim for the ROBOT-2 assessment due in week 4.
 - Try drawing a digit
- Next week we will cover the RTDE and RVC Toolboxes which can also be used for the ROBOT-2 assessment. You may wish to look through the reference material provided.
- Try to implement more advanced program and or incorporate a few advanced mechanisms.

