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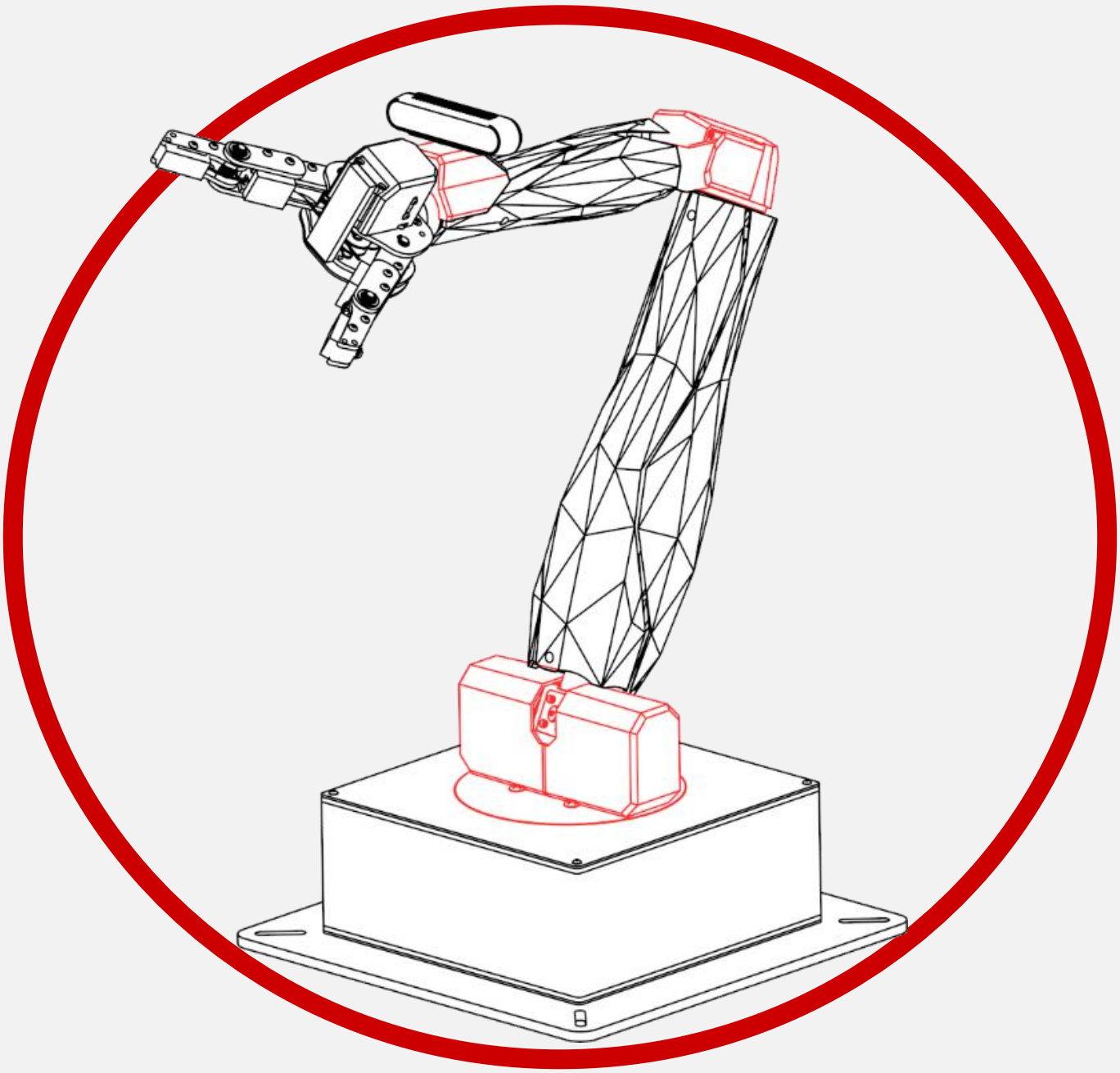

QArm

Lead Through

V1.0 – 13th February 2025

For more information on the solutions Quanser offers,
please visit the web site at: http://www.quanser.com

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Caution

This equipment is designed to be used for educational and research purposes and is not intended for use by the public. The user is responsible for ensuring that the equipment will be used by technically qualified personnel only. Users are responsible for certifying any modifications or additions they make to the default configuration.

QArm – Application Guide

Lead Through

Why explore Lead Through?

Often with industrial manipulator applications such as welding, a process must leverage a robot's ability to carry out a task with high accuracy and repeatability, while also leveraging the operator's skill and experience with deciding the path taken by the tool of interest, for example, a welding torch. For such hybrid operator-machine applications, 'Lead Through' allows the operator to physically drive the end-effector and tool through the path of interest, while the manipulator learns the trajectory. This lab will include two parts. The first section will have you implement code to allow the manipulator to record/learn the path it follows. The second section will then have the manipulator repeat the trajectories in a separate task.

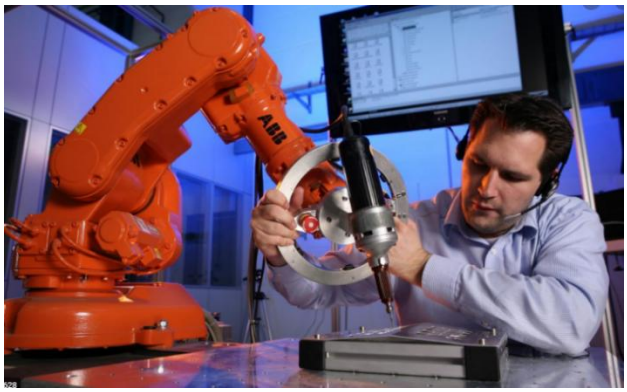

Figure 1 SMErobot invention by ABB: Lead-Through-Programming (Image credit: ABB AG)

Background

The QArm content contains 5 labs that focus on kinematic manipulation. The first one focuses on learning how to do low level control, workspace identification, lead through control, teach pendant and trajectory generation. This lab focuses on Lead Though is performed for a robotic manipulator.

Prior to starting this lab, please review the following concept reviews (should be located in Documents/Quanser/4_concept_reviews/),

- Concept Review –Manipulator Lead Through

Getting started

The goal of this lab is to study the process for teaching a robotic manipulator how to record and replay motion described by an operator.

Before you begin this lab, ensure that the following criteria are met.

- The QArm has been setup and tested. See the QArm Quick Start Guide for details on this step.
- You are familiar with the basics of Simulink. See the Simulink Onramp for more help with getting started with Simulink.

Operating Procedure

When working with the physical manipulator, you will safely be able to interact with it and move it by hand during the learning phase. When working with the virtual manipulator, physical interactions are not possible. In this case, you will use the keyboard to drive the arm instead. Your keyboard commands will be interpreted as end-effector linear speeds in the 3 cartesian directions, making the interface to the robot intuitive. A forward kinematics formulation will be used to track the end-effector position while you move the arm along a specified operational path. After the data logging is complete, a separate software routing will use the stored joint angles as command inputs to the manipulator.

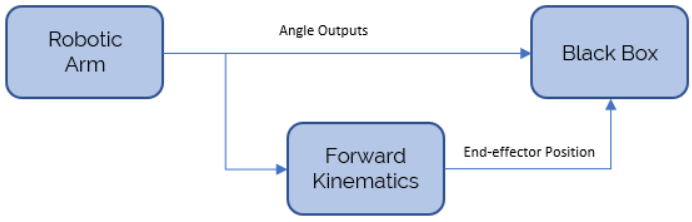

Figure 3 Lead Through Workflow Diagram for Learning the Path

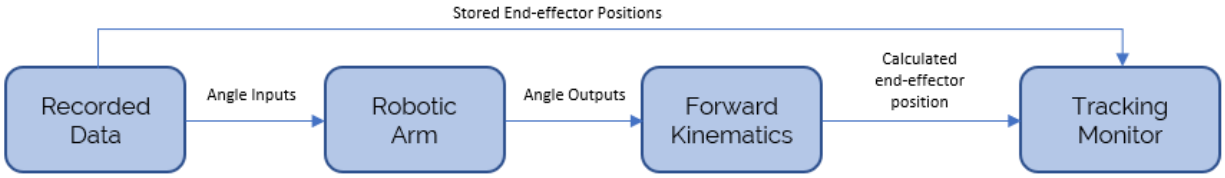

Figure 4 Lead Through Workflow Diagram for Executing the Path