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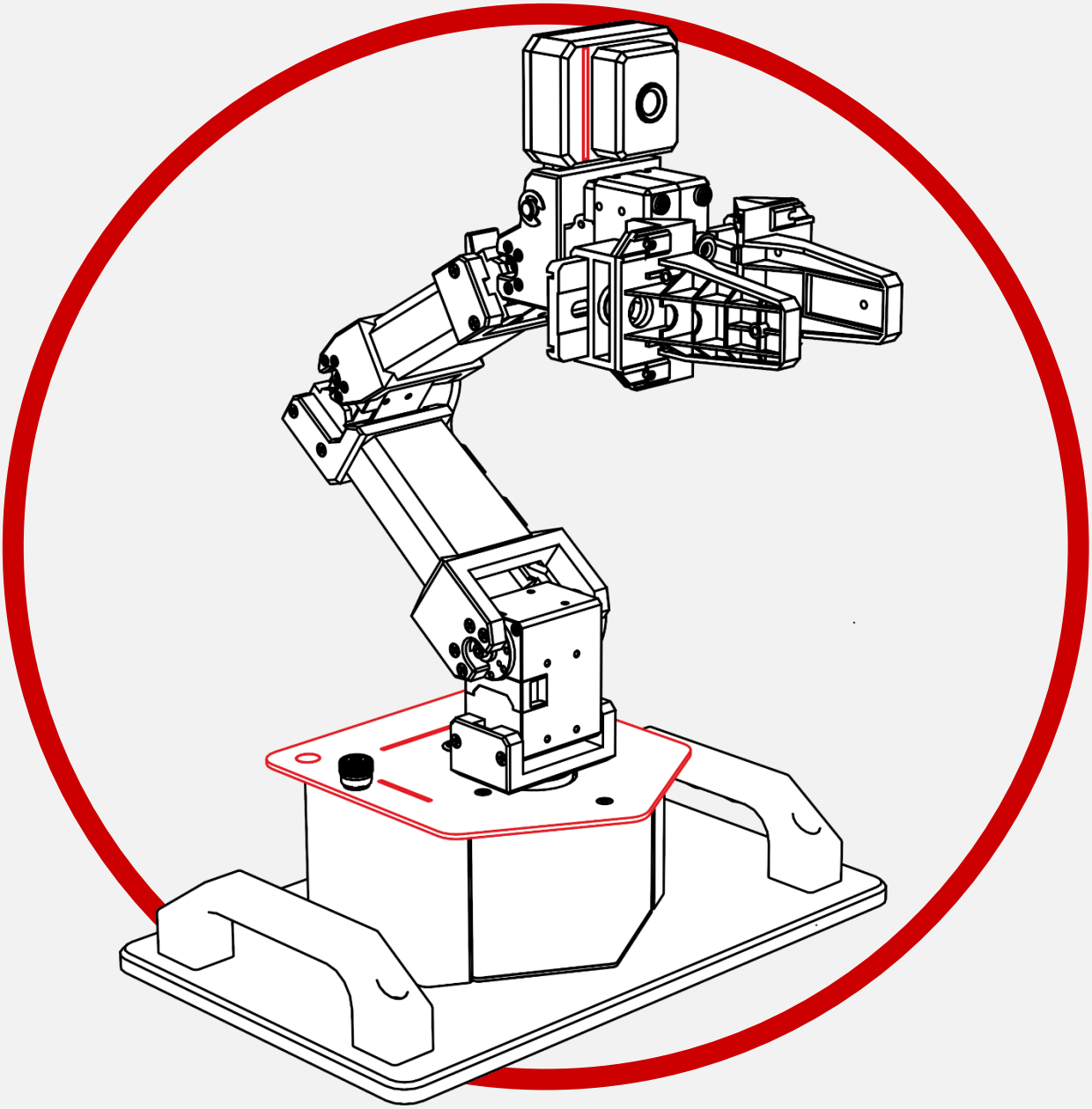

QArm Mini

Forward Kinematics

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QArm Mini – Application Guide

Forward Kinematics

What is Forward Kinematics?

Forward kinematics is the process of determining a manipulator's end-effector position and orientation based on its joint angles. In robotic systems, each joint's movement affects the overall configuration of the arm, making forward kinematics essential for predicting how the manipulator interacts with its environment. This mathematical relationship allows us to calculate where the end-effector will be relative to the robot's fixed base frame. Understanding forward kinematics is crucial for applications that require precise positioning, such as assembly, inspection, and welding.

In this lab, you will explore the practical applications of forward kinematics using the QArm Mini manipulator. You will map the robot's workspace—the set of all possible positions the end-effector can reach—and observe how joint movements influence its motion. This knowledge is applied in real-world tasks like lead-through welding, where the manipulator follows and replicates a path demonstrated by the operator.

Background

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

- Concept Review – Robotics → Position Kinematics
- Concept Review – Robotics → Manipulator Lead Through

Getting started

In this lab, you will examine how joint angles determine the end-effector's position and orientation. The lab consists of two parts: mapping the manipulator's workspace and performing a lead-through welding task.

Ensure you have completed the following labs

- **Play Lab**

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

- If using a physical QArm Mini, make sure it is securely attached to the base and the manipulator is in the rest position. See the QArm Mini 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.