

QArm Recommended Assessment

Basic I/O

1. Create a schematic diagram showing the positive convention of the manipulator when operating in position mode.

To determine the positive convention/direction of the manipulator, command small positive angles (e.g. $+0.5$ rad) to each of the joints and note the direction of rotation.



Figure 1: Schematic diagram of the positive convention of the QArm

2. Do both position mode and PWM mode follow the same positive convention? For example, does commanding the base joint a positive PWM signal cause it to rotate in the same direction as commanding it a positive angle in position mode?

Yes, both position mode and PWM mode follow the same positive convention as illustrated in Fig. 1.

3. In theory, what voltage will you apply to hold the QArm at the home position, with gravity and without gravity?

In a space where there is no gravity, you do not need to apply any voltage to any joint to keep the arm at the home position. With gravity present, each joint needs a torque to counteract the torques applied to the manipulator under the gravitational effect acting on the links. However, a constant voltage applied to the joints will cause them to move at a constant speed, which by nature implies the inability to hold a position. This is why a controller is required.

4. Provide at least one reason why you would develop your own position controller using PWM mode as opposed to using the built-in PID position controller.

Generally, the idea is that most robotic arms are supplied with built-in controllers that meet certain performance criteria (typically critically or over damped). However, depending on the application, you may want a different response characteristic (e.g. faster peak-time regardless or no overshoot). PWM mode allows you to create a controller that meets the desired dynamic response and performance