Chapter 5 Review Questions Answer Key

1. Where do we attach the end-of-arm tooling?

   A: End-of-arm-toolings (EOATs) attach to the end of the robot's wrist or minor axes.

2. What is the difference between angular grippers and parallel grippers?

   A: Parallel grippers have fingers that move in straight lines towards the center or outside of the part to close and grip or open and release the part respectively. Angular grippers have fingers that hinge or pivot on a point to move the tips outward to release parts or inward to grip parts.

3. If you need a gripper for a wide range of part sizes, which would be better: parallel or angular grippers? Why?

   A: Parallel grippers because they have the ability to grip a wider range of parts, depending on how far the fingers can travel.

4. Which types of environments are hydraulic or pneumatic grippers well suited to?

   A: Hydraulic and pneumatic grippers are great for wet, dusty, or explosive environments.

5. When we power grippers in only one direction, how is the other motion achieved?

   A: The other passive motion is controlled by another means, such as spring pressure or mechanical tension.

6. Which precaution should one take regardless of the type of gripper or power source for the gripper?

A: When working with grippers, regardless of the type, take special care to ensure that no damage occurs to parts and/or people during shutdowns or unexpected power loss.

7. To center a part in two directions at once, what is the recommended number of fingers on a gripper?

   A: Three or four.

8. For odd-shaped parts, which type of gripper will you need?

   A: Some four fingered grippers and grippers having five or more fingers.

9. What are the four rules for determining which gripper to use?

   A: 1. The tooling must be capable of holding, centering, and/or manipulating the range of parts the robot will work with.

   2. There needs to be some way of sensing when a gripper has closed on the part or if it is empty. This can be internal to the gripper or provided externally depending on the system. Newer grippers can determine the amount of force exerted on the part as well, which is very beneficial for delicate materials.

   3. The weight of the gripper should be kept as light as possible as this weight is deducted from the robot's total payload.

   4. Proper safety features built into the gripper for the environment it will work in and the parts it will work with. (For instance, the ability to hold parts even when power is lost, or fingers made from non-sparking materials for flammable environments.)

10. When determining the force required from a gripper, which factors do we consider?

A: Part size and shape, direction we are moving the part, friction, size of the gripper, and any safety factor we want to build in.

11. How does an electromagnet work?

A: When a coil of copper wire has current running through it, it generates a magnetic field. If we coil this wire around or inside a metallic frame and pass current through the wire, we create an electromagnet that attracts ferrous metals, or metals that contain iron. Once the electricity stops flowing, the magnetic force dissipates and the gripper releases the ferrous metals it attracted.

12. How does an Venturi valve work?

A: Compressed air is passed through a conical Venturi orifice, as the air passes from the restriction to the larger area, the pressure falls and the velocity increases. Because of the large difference between the conical restriction and the line after it, an intense reaction is created that sucks the stationary air out of the area of the vacuum cup or wherever the air opening is attached into the main line after the Venturi valve.

13. What is the difference between MIG welding and laser welding?

A: MIG welding uses wire and electricity whereas laser welding uses intense beams of light to fuse the metal.

14. Explain how collision software is utilized to protect robot tooling.

A: The software monitors the motor current and in the event of a sudden spike or increase in motor current, the software stops robot motion to prevent damage to the torch or tooling.

15. What are the two types of wire feed devices for welding and which type of metal does each work with?

    A: There are two types of wire feeders: the push type and the pull type. The push type works with hard metals and the pull type is for softer metals.

16. What are some of the features of welding controlled by a weld schedule?

    A: Weld voltage, weld current, and wire feed speed necessary to complete the weld process, pressure and gun time.

17. Describe the process of spot welding.

    A: Spot welding uses a device call a gun, which resembles a large copper clamp, to fuse metal together by passing current from one tip to the other, through the material fused.

18. What are the two configurations of spot welding guns and what are the power source options for the closing action?

    A: C type and X type. The power options are pneumatic, hydraulic, and servo motor.

19. Describe the process of ultrasonic welding.

    A: The process of an ultrasonic weld begins with the materials to be fused placed in a fixture known as the nest. The horn is then brought into contact with the materials and pressure is applied to clamp the parts together between the horn and fixture. At this point the welding process is engaged and the horn vibrates at whatever frequency the system is set for. Though the horn only travels thousandths of an inch or microns of distance, it does it thousands of times per second, generating frictional heat in the clamped materials.

As the materials heat up they fuse or weld and once this process is complete the hold time begins where the horn applies pressure, but no vibration so the parts can solidify once more. Lastly, the horn retracts and if all has gone well, a new welded joint is left behind.

20. What are the two drawbacks to mounting multiple tools on the robot at the same time?

    A: First, this reduces the payload of the robot by the weight of two or more tools instead of just one, which reduces the force left to move parts and other materials. Second, this method often requires specialized tooling bases or tooling systems to allow for the multiple functionality.

21. What are the benefits of quick-change adaptors?

    A: The alignment pins provide consistent placement for the tooling and the coupling system provides for positive locking while making it easy to detach the current tooling and add new. These setups can transfer various power sources as well as make communication connections for any sensors the tooling may have.

22. Describe the operation of an automatic tool change system.

    A: In this case, the tooling is stored on a rotary wheel and rotated into position as needed where an empty spot takes the current tool after it is detached, rotates in the new tooling needed, and holds it in position while a positive lock with the robot is completed.

23. What is the difference between active and passive RCC units?

    A: Active RCC units have sensors inside the unit to detect how much side shift is occurring while passive RCC units use springs and shear plates.

24. How do vision systems help with part misalignment or variance in parts?

A: With vision systems, the robot uses a camera to take a picture of the part and then compares this picture to sorting criteria predefined by the programmer. Once the system has filtered the visual information, it runs a subroutine that allows it to offset the tooling positioning in relation to the new part position.