**CHE244**

**Stoll**

**Spring 2020**

**Assignment #5 – Motion Control Questions – 15 points – Due May 4th**

1. Give three concrete examples of the use of stepper/servo motors and motion control (as discussed in the reading material) in a science laboratory.
2. Explain the difference between a servo motor and a stepper motor. How are they functionally different? What are some advantages and disadvantages of each on the context of motion control.
3. Suppose you are going to build a syringe pump using a stepper motor that has a resolution of 200 steps per full revolution of the motor. The screw driving the syringe plunger will have 10 threads/cm. To obtain a smooth flow rate from the syringe you need to avoid stopping the screw turning for more than 100 ms between steps of the motor. Assume that the rotational speed is 0.1 rotations per second during each step. If you use a 1 mL syringe and the plunger diameter is 4.6 mm, what is the lowest flow rate you can deliver under these conditions?
4. Suppose you want to build a XYZ robot that can pipet small volumes (< 1 µL) of liquid and deposit them on glass surface. The robot arm will be driven by three stepper motors to control movement in the X, Y, and Z directions. If the screws driving movement in the X and Y directions have 10 threads/cm, and the motor rotates 1.8° per step, what will be the spatial resolution with which you can control the positioning of a droplet on the glass surface? In other words, if you want to deposit a droplet in a position that is 1 cm down from the top edge of the surface, and 1 cm to the right of the left edge, how close can you get to that target reproducibly?