

Prototype Test Plan (Printhead Extrusion System - Auger Flowrate Test)

Product Description	A cylindrical container (32fl-oz) with an auger driven by a NEMA 17 stepper motor.
Objectives	Determine the optimum operating voltage (and thereby a feasible flow rate).
Techniques	<p>Generate a list of speeds that you would like to observe. Using the geometry and material properties of the extruder force to formulate a calculation to determine the load torque which results at specific velocity for an optimal flow rate. Use the torque-speed characteristics of the motor to determine what voltages should be applied to achieve the precise torque.</p> <p>Generate an Assembly program which continuously outputs a voltage level while monitoring the angular velocity. Include a section of code which functions as a velocity limiter, for safety. 100rpm may be considered as an upper-bound. For each of the voltages calculated above, apply the voltage until steady-state is reached. Compare the actual angular velocity to the estimated speed. Make adjustments to the voltage level until the desired speed is observed.</p>
Success Criteria	A set of approximating calculations are formulated for relating the angular velocity, torque, and voltage of this auger printhead system. A voltage is observed and recorded for each desired flow rate.
Resources	The auger system is operated by a 24v power supply. The mixed-signal processor requires connection to an IDE for code generation, debugging, and sensor feedback. Concrete mixture is necessary to observe the mixer-concrete interactions.
Schedule	The experiment setup includes theoretical calculation, generating code, mixing concrete, and experimenting. A procedure time estimate is 4 hours. The lab should be performed in the CET lab so that concrete can be used safely.



Special Considerations	Cement is a general irritant, a filter mask, eye protection, gloves, and sleeves should be worn. The code should include a velocity limiter such that the motor does not reach too high of a speed, which may result in injury or mess.
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