Theory

The current I through a circuit can be found using a shunt resistor with a designated maximum current I_s, and a shunt voltage V_s. The resistance in the shunt is then:

$$R_s = \frac{V_s}{I_s} \tag{1}$$

The current at any given time across the circuit can then be found as:

$$I = \frac{V_i}{R_s} \tag{2}$$

Here V_i is the instantaneous voltage across the shunt resistor. The shaft power produced by an electric motor can then be found as:

$$P = I \cdot V_B \tag{3}$$

Where I is the current and V_B is the source voltage. This value, along with the rotational speed n, can be used to calculate the motor torque, T:

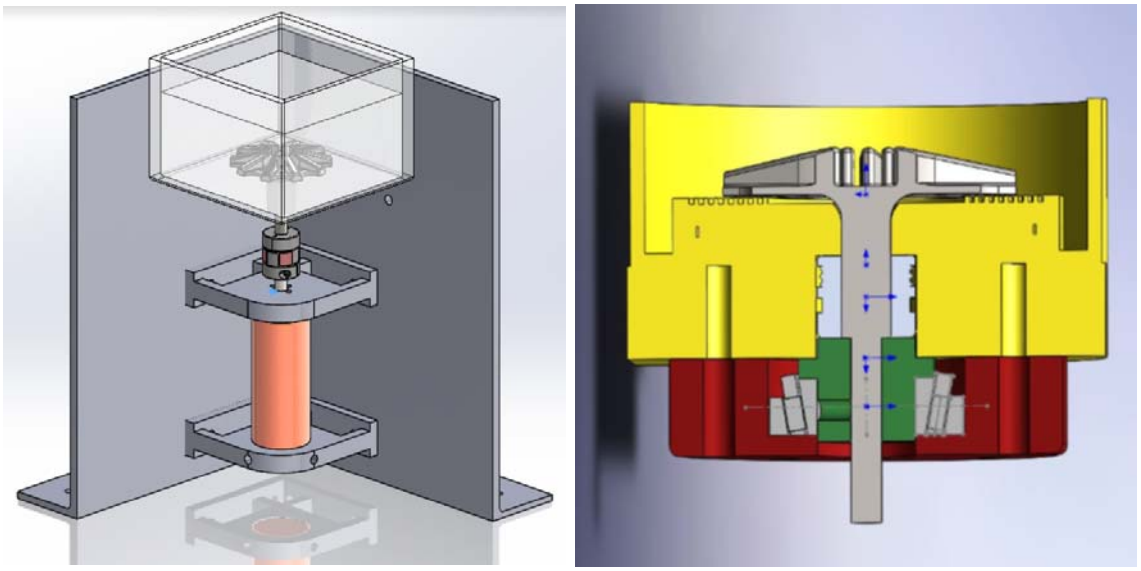
$$T = \frac{(9.549)P}{n} \tag{4}$$

If P is plotted against n, the slope of the best fit line multiplied by the factor of 9.549 will provide an approximate value for the motor torque.

Methods and Materials

Apparatus

The pump housing was adapted to leave one side open, allowing for the insertion of an acrylic tank to contain the test fluid. The rotating elements were assembled as they would be in the final pump, including the impeller, seal, thrust bearing, and shaft collar. A cross-section of this assembly can be seen in Figure 1b. The rotation rate of the shaft was measured using a digital photo tachometer aligned with a reflective marking on the rotating element for the tachometer to register each cycle. This can be seen in Figure (tachometer). The current was found by measuring the voltage drop across a shunt resistor. This circuit is shown in Figure (Shunt circuit).



(a) Assembled Apparatus (b) Cross-Section of Rotating Elements

Figure 1: Motor Performance Test Apparatus