Ch. 22: Permant Magnet Brushed DC Motor Characteristics

22.1)
The mechatronic system shown in Figure 22.12 is designed to periodically hoist a 10 oz. mass above a platform where it is normally resting. The spool has radius 3/8 in., and is directly connected to the output shaft of the motor. If the motor has a stall torque of 29.5 in.·oz. at 15 V, what is the minimum voltage required to hoist the mass?

22.3)
A motor with K_T = 105 mNm/A, R_{COIL} = 10 Ohms and ω_{NL} (at 48 V) = 4,320 rpm will be operated with a 48 V supply. If this motor is connected to a mechanism that has frictional torque losses of T_f, = 55 mNm, what will its output shaft rotational speed be?

22.6)
A motor with K_T = 16.1 mNm/A, R_{COIL} = 1.33 Ohms and ω_{NL} (at 18 V) = 10,300 rpm will be operated with an 18 V supply. The maximum permissible continuous torque specification is 24.2 mNm. What rotational speed does this correspond to?

22.8)
What are the roles of the commutator and brushes in a brushed DC motor?

22.9)
A motor has a measured R = 14.5 Ohms, and a measured stall torque of 4.47 mNm when operated on 9 V. What is the expected no-load speed of this motor? You should ignore motor friction for this problem.

22.10)
A motor has a measured no-load speed of 11,500 rpm, measured stall torque of 4.47 mNm. What is the expected speed of this motor when delivering 1.0 mNm of torque into an external load?