ME 333 Quiz 9

Gears and Brushed DC Motor Control

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Quiz 9

1) **Gears are often used to reduce motor speed and increase output torque. List two complications that gears add to a system and why they are disadvantageous:**

- Efficiency: Some power is lost due to friction between teeth of the gears. Total efficiency is the product of each stage in a multi-stage gearhead. Thus, high ratio gearheads can have low efficiency.
- Backlash: Backlash is the angle the output shaft can rotate without the input shaft moving. Gear teeth need some play to avoid jamming when they mesh. As a result, backlash is introduced due to tolerances in manufacturing. This can be a serious issue in controlling endpoint motions.

2) **Draw a motor connected to 4 switches in an h-bridge configuration, label the switches 1 through 4:**

3) **Pretend a pair of switches has been closed for a long time while the motor has been stalled. The switches are then opened. Add two flyback diodes to protect the two switches from sparks to your picture in #1, clearly showing which switches just opened and the relative position of the diodes that protect them.**

4) **Why does a current control loop typically occur much more frequently than a position control loop?**

The current loop must have a faster response time than the motion control loop. Otherwise, the current loop will have little effect on the motion control loop. The motion control loop takes desired and actual position and outputs a current based on those inputs. The current control loop attempts to deliver the current requested ny the outer loop (motion control), taking actual current as an input and outputting a voltage.