QuadCopter DC Motor(BLDC) + Propeller Dynamics

Ultimately we'll buy Electronic Speed Controllers (ESCs) for our Quad motors. They take PWM in and produce drive voltages for brushless DC motors. Let's jump in to understand the motor-propeller subsystem on a quadrotor.

DC Motor Modelling

You'll find basic DC motor equations in any undergraduate dynamics textbook. I add the Bouabdallah model for the drag term, which for a simple motor would be the back-emf alone, but here we account for propeller and gearbox drag referred to the motor shaft as you can see below.

The motor-propeller speed model is non-linear. The Taylor Series expansion and evaluation about a nominal operating point is used to linearize it.

I'll leave this post to cover derivation of the propeller-motor equation with drive voltage as the control input. This will fit within the larger quadrotor system picture later, after we build more sub-system understanding.

BLDC