Quadrotor Roll, Pitch and Yaw Axis Lead Compensation (PID)

In the last post I simplified the model to arrive at a transfer function representing the roll and pitch axes independently for our ‘+’ shaped quadrotor.

The following video explains how we stabilize this inherently unstable system. The PDF that follows is produced from the Maple document I review in the video.

This, “lead-compensator” design represents the ‘P’ & ‘D’ relative to the PID acronym for Proportional-Integral-Derivative control.

The following video walks-through the PDF below, covering the parameters and design methodology employed for the roll and pitch axes. The PDF concludes with similar design technique for the yaw axis.

Classical_Roll_And_Yaw_Axis_Model

Conclusion

This concludes the paper design of a “classical” control system for platform stabilization, “to hover” for the quadrotor system. We covered a lot of ground to understand and to estimate the parameter values and equations required to populate the model. Now would be a great time to, “hit the bench” and test our design in, “the real world”.

However, I’m going to push through to non-level flight control, “paper design” because I already know we can, “tune” PID controllers for off-the-shelf quadcopters. It would be interesting to test parameter assumptions above and we’ll need to do that when we hit-the-bench at some point, but I’m going to explore what it would take to control a quadcopter over a larger, “flight envelope”: non-level flight.

An example might be a dynamic intercept course towards a moving target. This is a classic, “missile” guidance and control problem and it will be fun to consider how we could do this with our quad, and what type of control system we will need to perform this action.