

About the P3 controller response

The current, velocity, and position PI controllers are designed to provide a critically-damped response using two equal, real poles. The proportional and integral control gains required to achieve this are calculated based on the motor parameters V_{BUS} , R , L , K_T , and J , plus the user-input desired control bandwidths IBW , VBW , and PBW .

For the position controller, a critically-damped response may not be ideal because it will always overshoot then return to the commanded position. Decreasing the bandwidth does not help, as it only slows down the response- it does not prevent the overshoot that is inherent in a critically-damped system. See Figures 1-3:



Figure 1: Critically Damped, 8 Hz

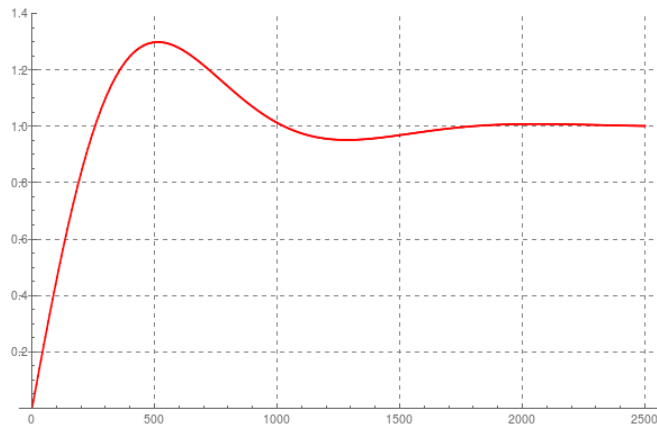


Figure 2: Critically Damped, 5 Hz



Figure 3: Critically Damped, 3 Hz

By eliminating the integral term, the response changes from critically-damped to over-damped. For position control, this may be desirable so as to not overshoot the target position. With an over-damped response, decreasing the bandwidth will result in a slower response without any overshoot. See Figures 4-6:



Figure 4: Over Damped, 8 Hz

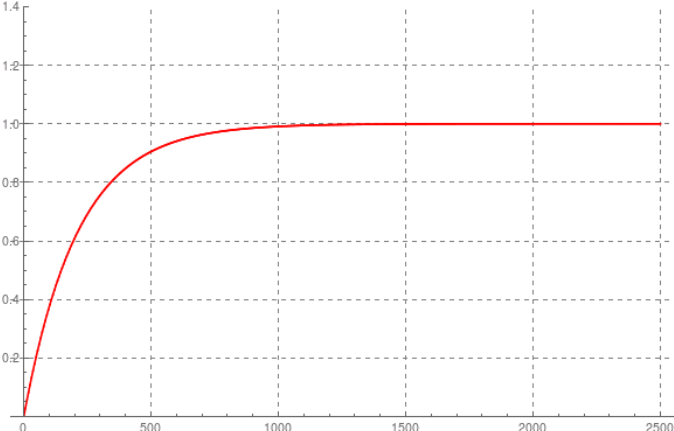


Figure 5: Over Damped, 5 Hz

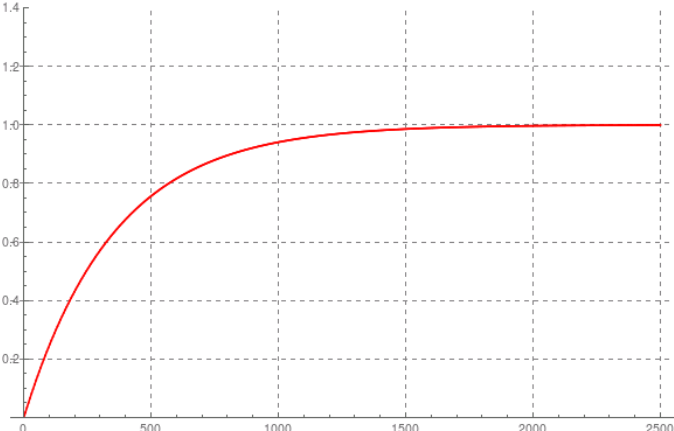


Figure 6: Over Damped, 3 Hz