

d) The PID controller forces the system to the reference level with high precision. For most angles, the error will be reduced to $\pm 0.01^\circ$ within 10 seconds, and will continue to approach zero with very high precision. This is compared to the PD controller from project 2 which, even with the non-linear compensation, would be off by $\pm 2^\circ$.

The main downside of this controller is the wind-up. For large angles, the arm will overshoot the reference by a large amount. This may cause the system to become unstable if θ becomes greater than 180° because of how the angles are mapped from -180° to 180° .