TIME TRIGGERED PID CONTROLLERS

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- Feedback controller used in industrial control systems
- Attempts to minimize error
- Relies on Position, Integral, Derivative Terms
- Requires limited system knowledge
Formulation

- $K_p P + K_i I + K_d D$
- Position (P) term
  - Feedback based on current error
- Integral (I) term
  - Feedback based on the aggregate error
- Derivative (D) term
  - Feedback based on the rate of change of error
Velocity Controller

\[ V' = a + F \]

F is a random force

Considered safe if \( V_{\text{min}} \leq v \leq V_{\text{max}} \)

PID velocity controllers used in industrial systems

- Ex European Train Control System
Proof

- Ensure that P term dominates at \( V_{\text{min}} \) and \( V_{\text{max}} \)
- Constrain the Integral term: \(-I_{\text{max}} \leq I \leq I_{\text{max}}\)
  - Common approach in PID implementation
Results

- Proved Safety of PID velocity controller
- Guarantees proper operation of systems using PID velocity controllers
- Provides insight into hybrid controllers with a PID velocity controller
- Provides bounds on $K_p, K_i, K_d$ that can be used for online calibration