Characterization of an Electronic Throttle Body

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Problem
• Electronic throttle bodies (ETB) control airflow into a car engine.
• Replaced old mechanically linked throttle bodies with drive by wire.
• Can be programed to change the driving characteristics of the car

Data analysis
• Response to a known signal was recorded
• Valve angle as a function of time
• Second order system
• Iterative method used to find characteristic equation:
  \[ \ddot{\theta} + 73.524\dot{\theta} + 308.14\theta = U \]

Tuning GUI
• Used to provide a better understanding of how PID parameters change response characteristics.
• Compares simulation to real world results.

Hardware Setup
• Arduino used for readout and control circuitry
• Hall effect sensor for valve position readout
• External power supply used to power ETB

Controller
• A Proportional Integral Derivative (PID) controller was implemented
• Controller runs at 16Hz
• Tuned using MatLab’s® pidtune function
• PID coefficients:
  \[ k_p=43.49, k_i=0, k_D=0.0399 \]

Conclusions
• Characteristic equation for ETB identified
• PID controller implemented and tuned
• GUI developed for real-time prototyping

Acknowledgments

References