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Plant Process Emulator

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How it Works

By using Proportional-Integral-Derivative (PID) Control, which is a control loop feedback mechanism, an error value $e(t)$ is calculated based off the difference between an user-defined set point and a measured process variable. The process variable is either the level transmitter for level control or a thermocouple for temperature control. After the error value is calculated, a correction is applied using the Proportional, Integral, and Derivative terms. The adjustment of a control variable $u(t)$ sets the position of a set of solenoid valves for level control or a heating element for temperature control. The control variable is set to a new value as determined by a weighted sum:

$$u(t) = K_p e(t) + K_i \int e(\tau) d\tau + K_d \frac{d}{dt} e(t)$$

where $K_p$, $K_i$, and $K_d$ are the coefficients for the Proportional, Integral, and Derivative terms. The Proportional term accounts for present values of the error. The Integral term accounts for the past values of the error. The Derivative term accounts for the future trends of the error.

Future Plans

Any future additions to this project would add to the current training capabilities of the overall system. Some potential future additions could include:

- Another method of control (Flow Control or Pressure Control)
- A combination of multiple processes (i.e. Flow Control with Level Control or Level Control with Temperature Control)
- Changing the physical layout of the components for portability and compactness
- Adding a PLC designated strictly for this training system.