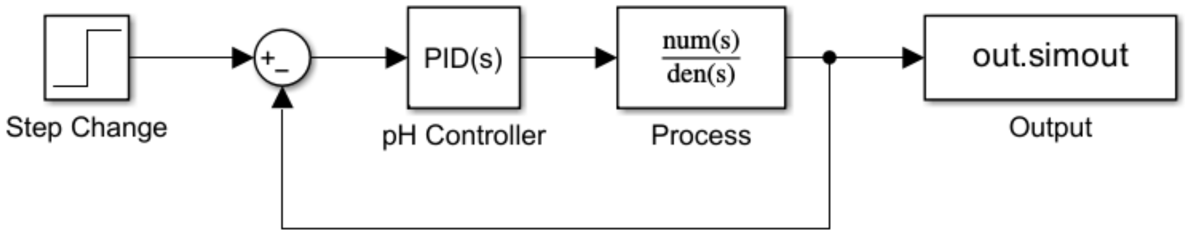
Development of pH Controller



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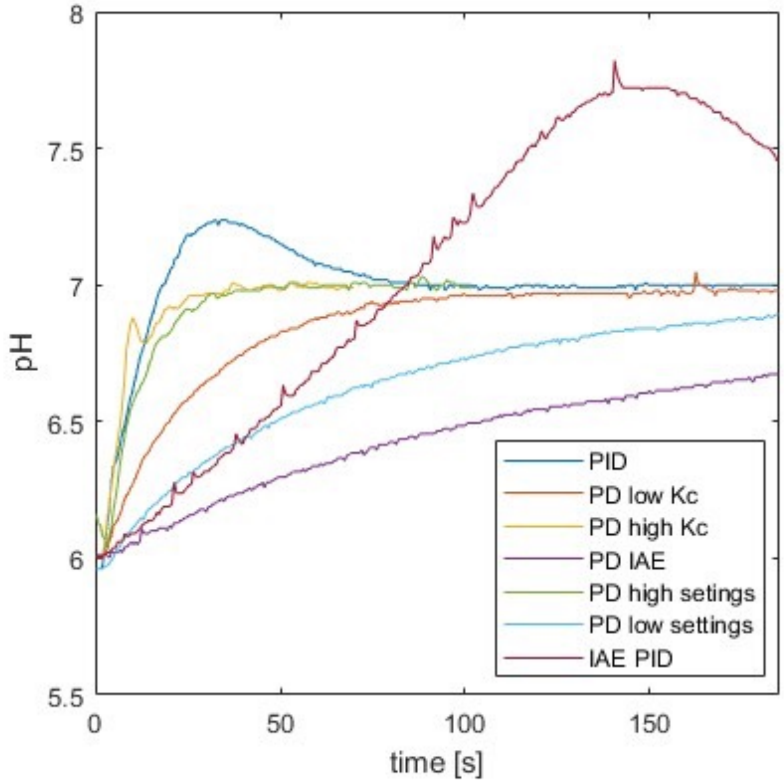

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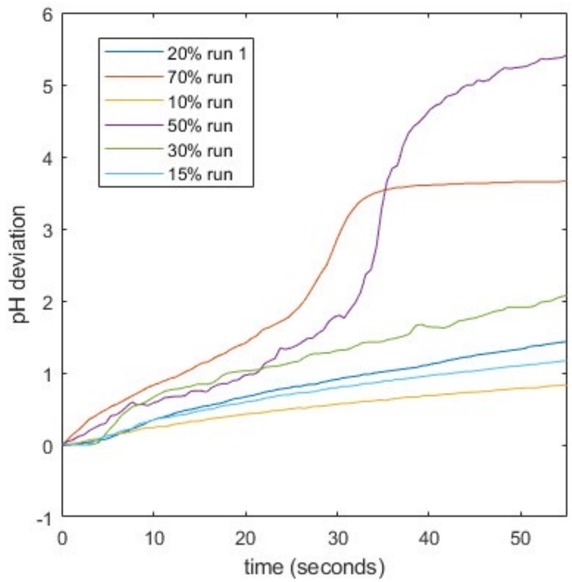
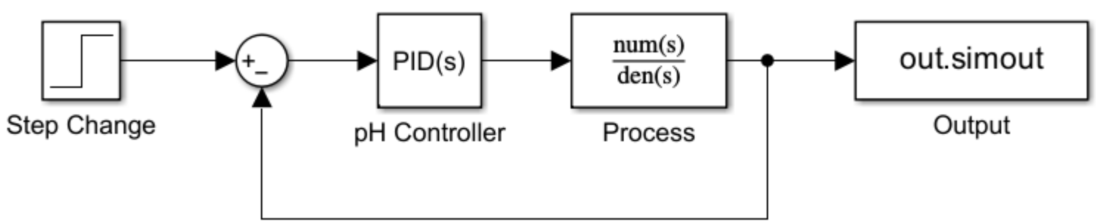
This presentation focuses on the design and tuning of a pH controller

$$Y(t) = MK\left[t - \tau\left(1 - e^{-\frac{t}{\tau}}\right)\right]$$

Modeling process



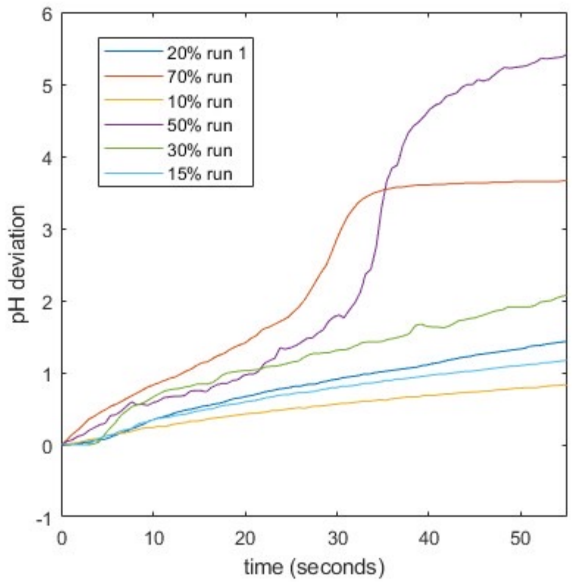
Fitting to experimental data

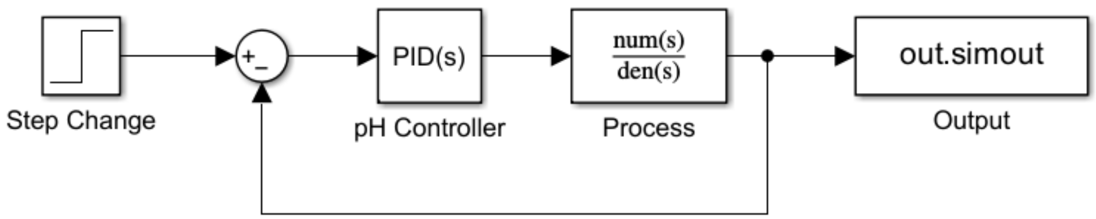


Tuning of controller

This presentation focuses on the design and tuning of a pH controller

$$Y(t) = MK\left[t - \tau\left(1 - e^{-\frac{t}{\tau}}\right)\right]$$ **Modeling process**



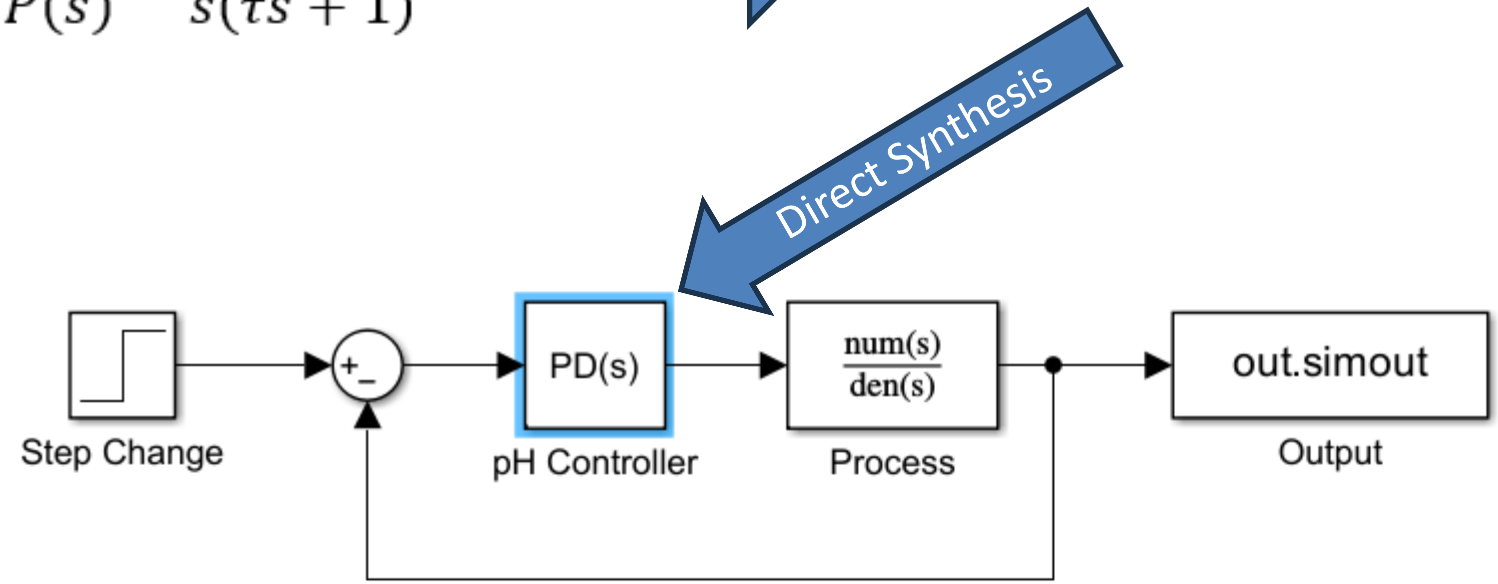


The semi-batch response can be modeled as process with its own integrator.

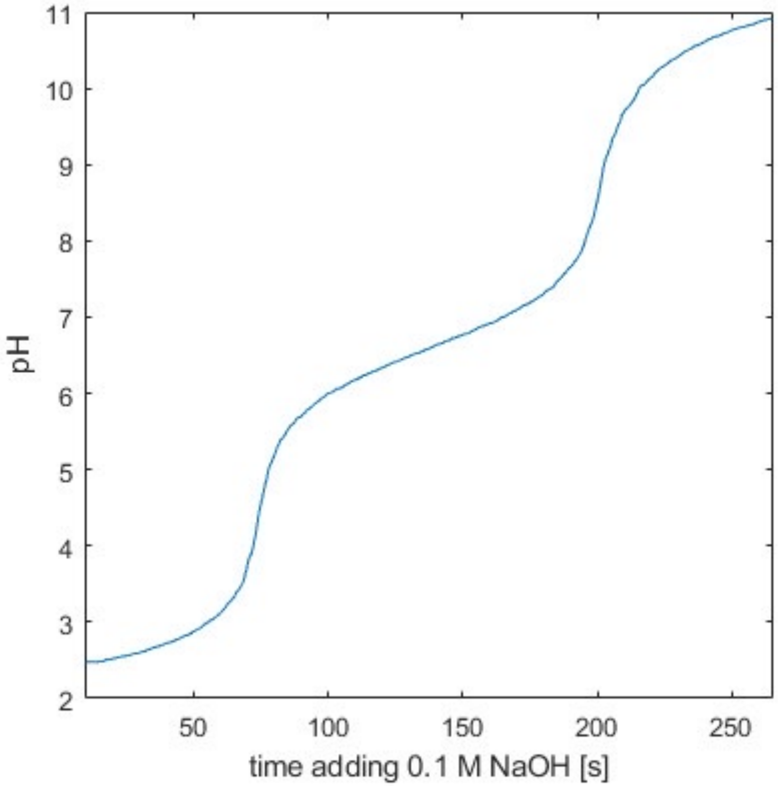
$$\frac{Y(s)}{P(s)} = \frac{K}{s(\tau s + 1)}$$

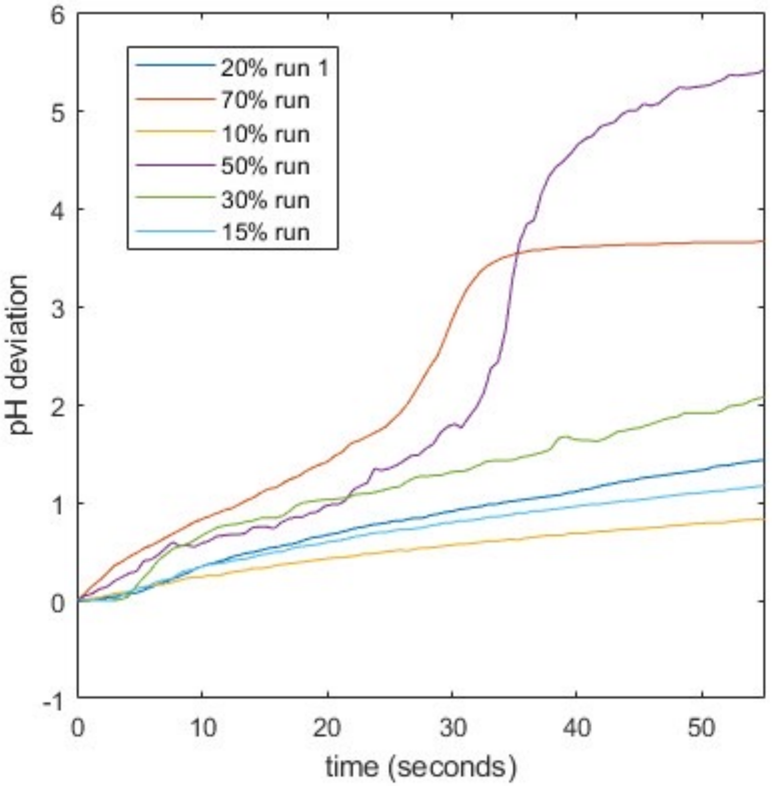
Step Input

$$Y(t) = MK\left[t - \tau\left(1 - e^{-\frac{t}{\tau}}\right)\right]$$

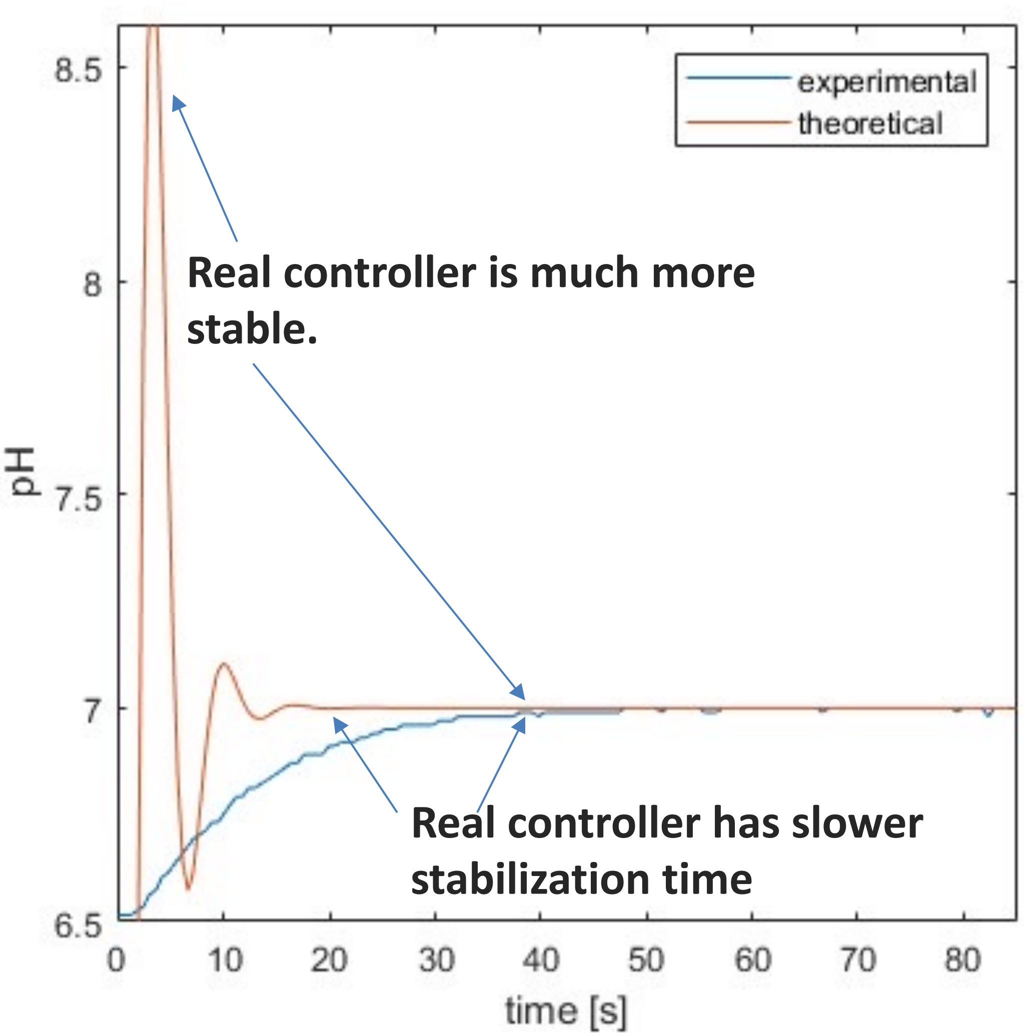


The buffer region is the simplest and best region of the pH curve to analyze for this controller.



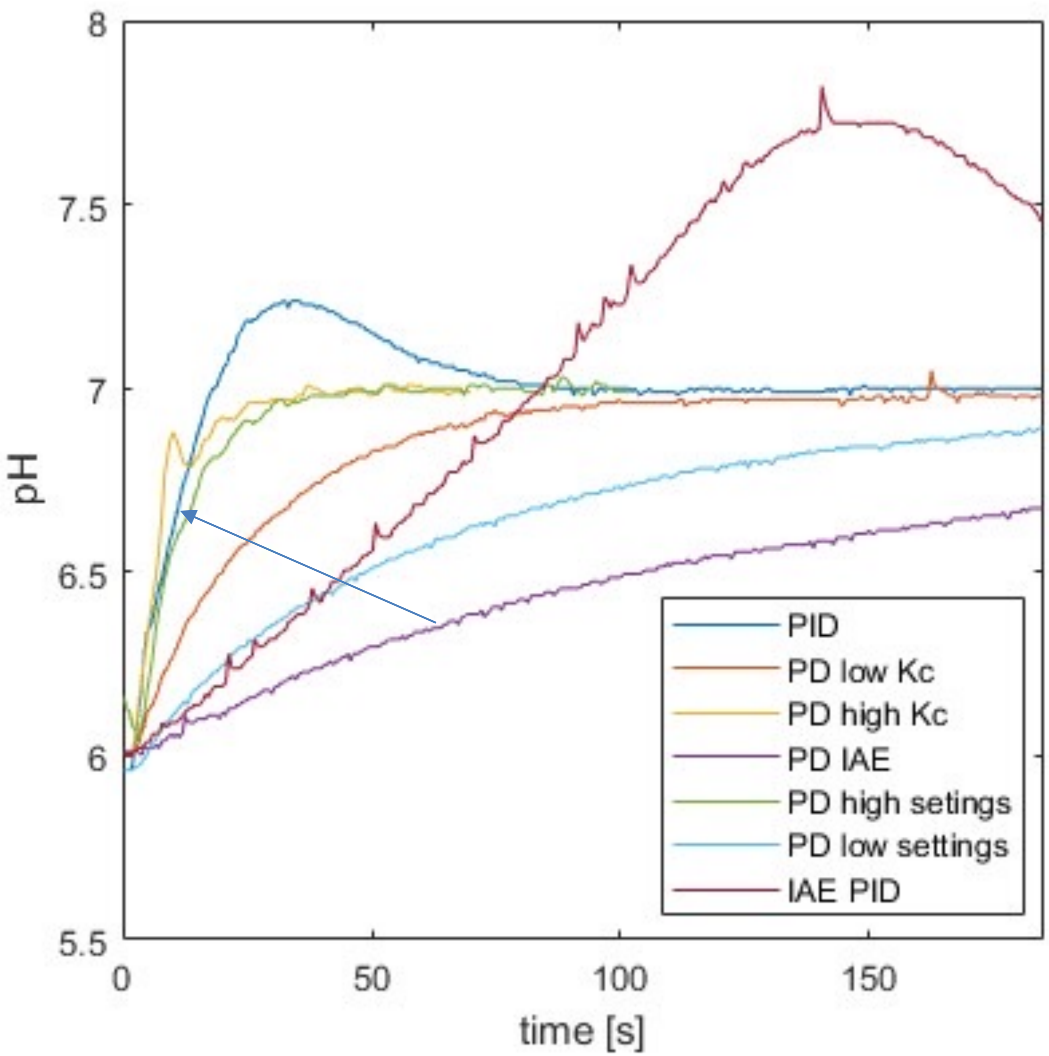


After fitting experimental data to our response function, the theoretical and real PD controllers can be compared.



In our findings, $K_C = 13.2$ and $\tau_D = 1.39\ seconds$

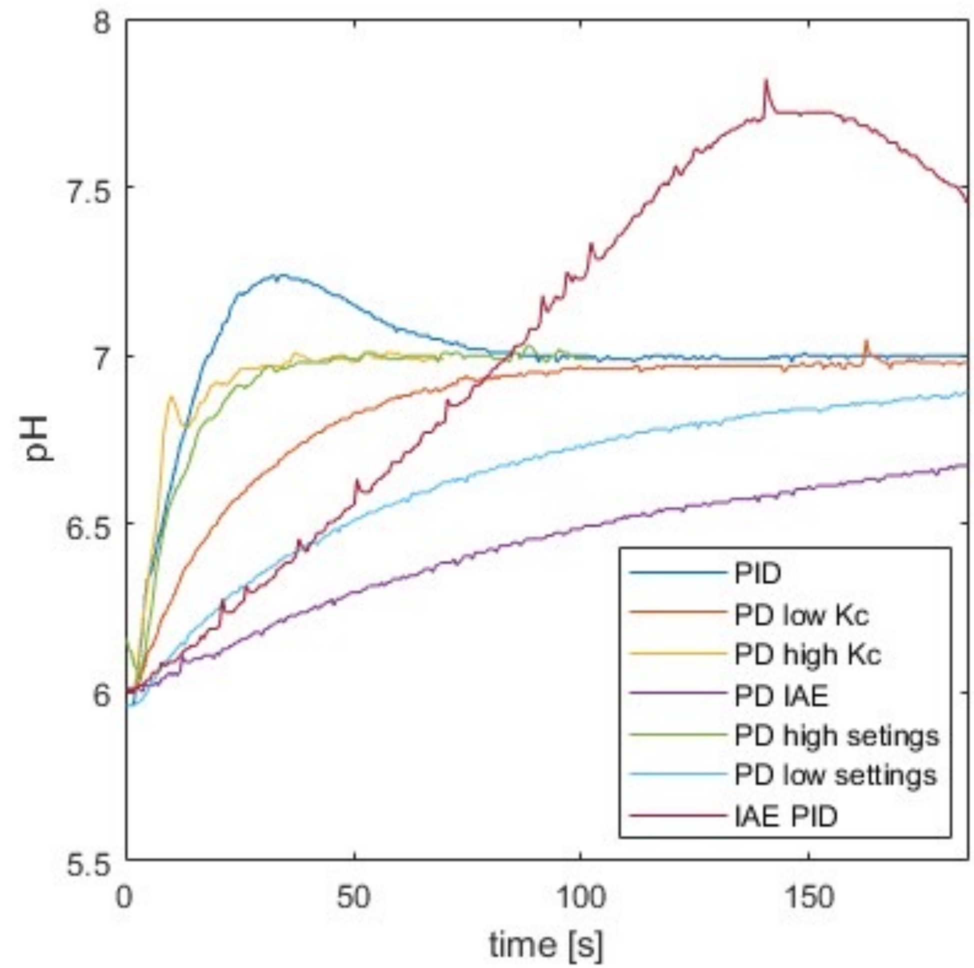
Further comparisons should be made to improve initial tunning parameters.



In conclusion, to control the pH of a semi-batch process, a PD controller should be used with a K_C higher than theory.

PD controllers with a high K_C are stable when maintaining pH.

A stable controller is desired to keep the pH from leaving our desired range.



Questions?

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