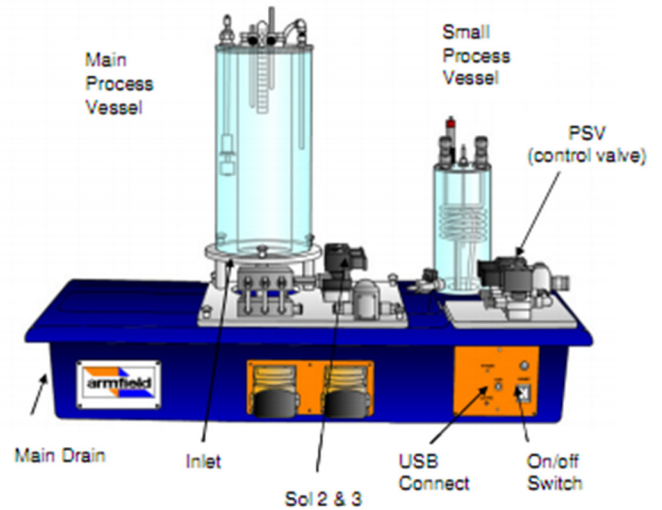


## ChE 436 Process Dynamics and Control

### Gravity Drained Tank Exercise

The gravity drained tank in the BYU Unit Operations Lab is a demonstration of closed loop control. In this exercise, you are requested to derive a closed loop transfer function for a PI controller.

Part a) The gravity drained tank height (mm) is maintained by adjusting the % open on an inlet line to a cylindrical tank. Derive the form of the process transfer function from a material balance.



Part b) Given the following transfer functions, derive a closed-loop transfer function ( $Y(s)/Y_{sp}(s)$ ), using the results from Part A for the process transfer function.

$$K_m = 1$$

$$G_c = K_c \left( 1 + \frac{1}{\tau_I s} \right)$$

$$G_v = 1$$

$$G_m = 1$$

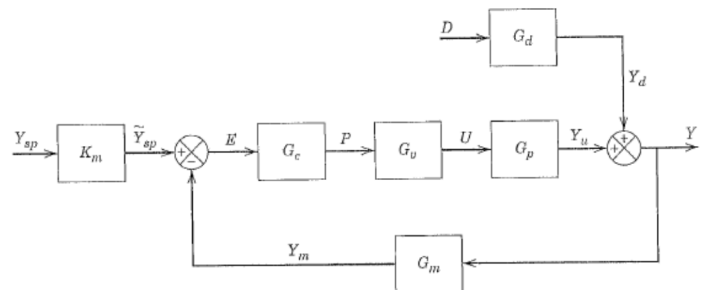


Figure 11.8 Standard block diagram of a feedback control system.

Part c) Put the closed-loop transfer function in standard form.

Part d) What is the order of the closed-loop system? Can the closed loop system oscillate or become unstable?

Part e) Repeat parts b-d for a PID controller with derivative on measurement.