Selecting the Right Feedback Controller

1. **Distinguishing Characteristics**
    a. P-only
        i. Accelerates the response of controlled process
        ii. Produces offset except for integrating (1/s) processes
    b. PI
        i. Eliminates offset
        ii. Usually higher maximum deviations than P-only
        iii. Sluggish, long oscillating responses
        iv. Increased gain may lead to larger oscillations and instability
    c. PID
        i. Introduces stabilizing effect on closed-loop response
        ii. Exacerbates noise
        iii. May cause additional wear on valves, etc.
2. **General Guidelines**
    a. If possible, use P-only
        i. Use if offset acceptable for moderate values of K_c
        ii. Use with integrating processes
    b. Use PI when P is unacceptable
        i. Systems that respond fast
    c. Use PID to increase the speed of closed-loop response if PI is sluggish
3. **Examples**
    a. Liquid-level control
        i. P-only
            1. integrating process
            2. maintain level within certain range – offset acceptable
    b. Gas pressure control
        i. P-only
            1. maintain pressure within certain range – offset acceptable
    c. Vapor pressure control
        i. PI
            1. direct control such as in flash tank where vapor valves is controlled to directly control vapor pressure – fast response
        ii. PID
            1. indirect control such as partial condenser on distillation column - control valve adjusts cooling water to change condensation rate – response may be too sluggish with PI
    d. Flow Control
        i. PI
            1. flow control is fast and direct – PI eliminates offset but D not necessary
    e. Temperature control
        i. PID
            1. heating and cooling jackets involving heats of reaction and slow mass transfer rates – slow, sluggish responses will usually require D action
    f. Composition control
        i. PID
            1. slow mass transfer rates usually require D action