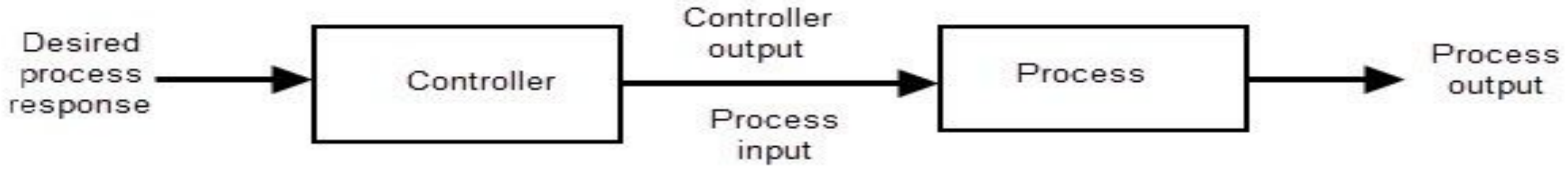
Control Systems

Day 9

Open Loop Control Systems

- No Feedback
- Time Dependant
- Reliable if proper calibration is done
- Cannot adapt to changes or disturbances

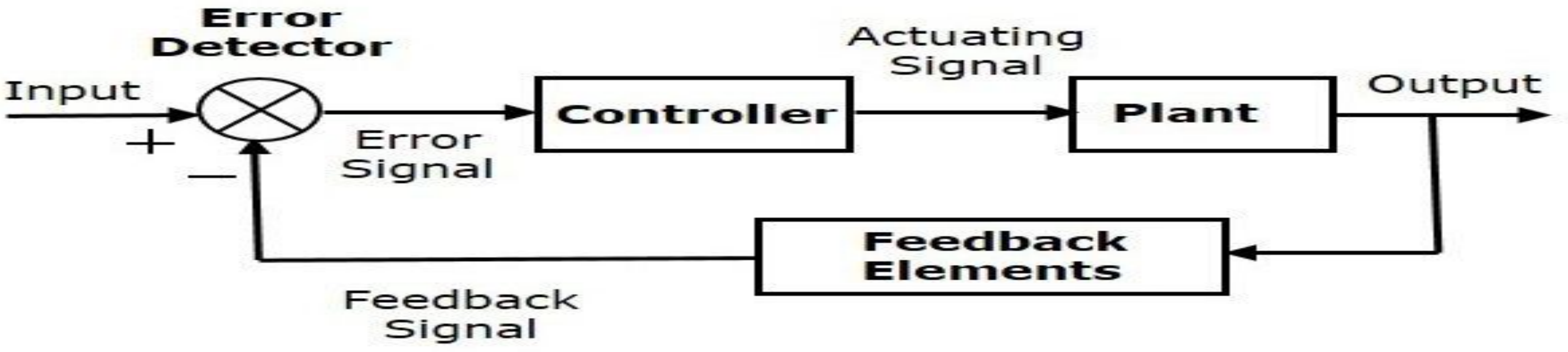
- Example: Traffic lights, Air cooler, Refrigerator, Washing machine etc.



Closed Loop Control Systems

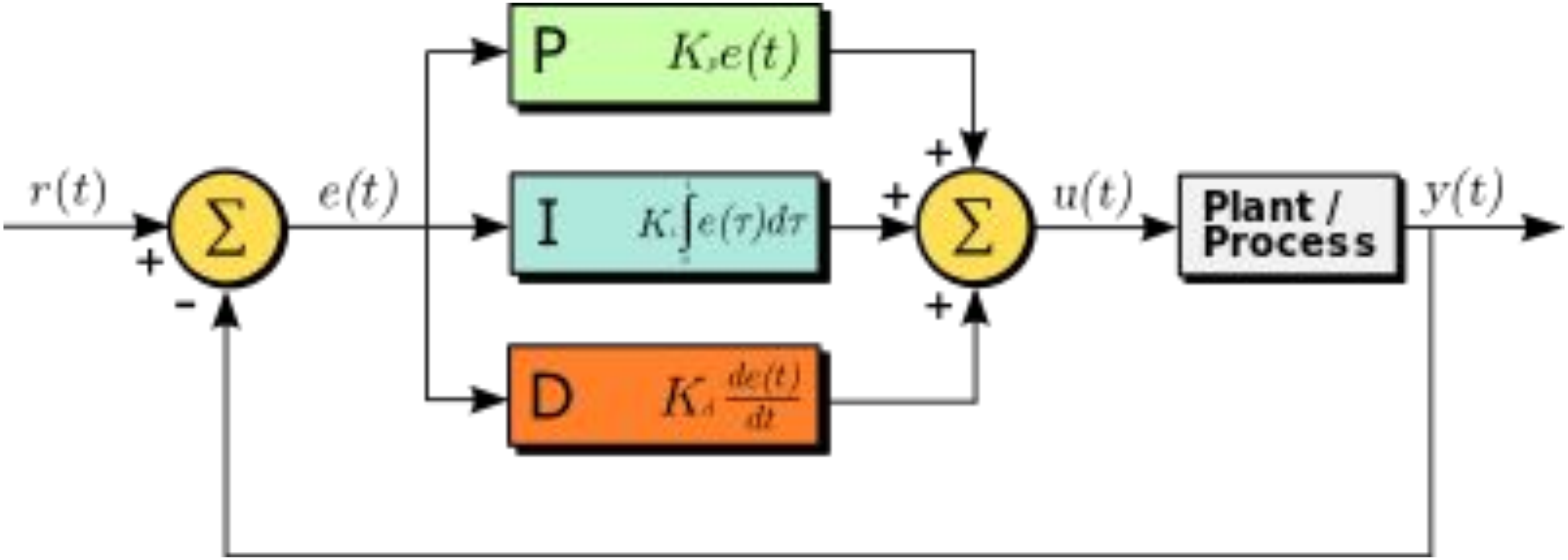
- Feedback using sensors
- Output dependant
- Can adapt to changes or disturbances
- Reliable

- Examples: Air conditioner, automatic traffic control system, electric iron etc.



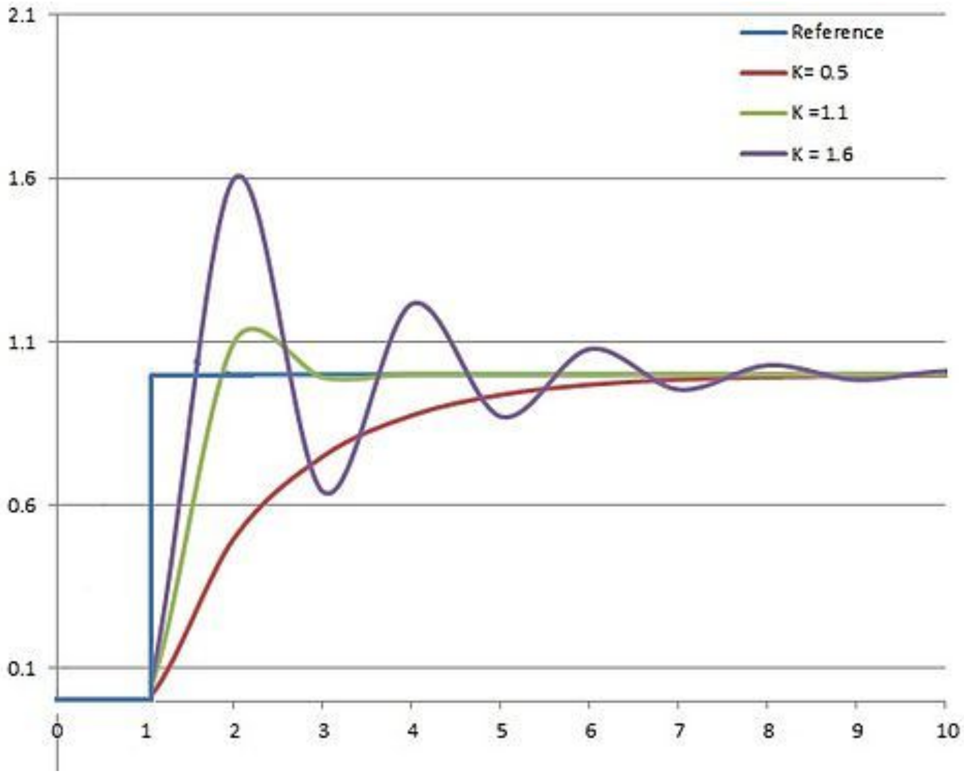
PID controller

- Stands for proportional, integral, derivative



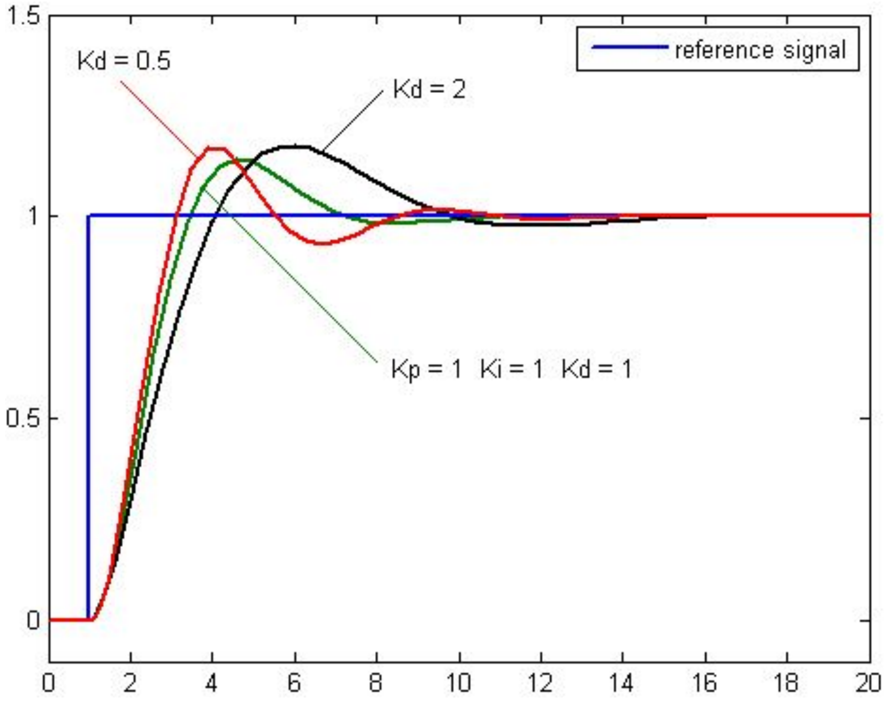
P gain (Kp)

- Error is multiplied with a constant gain.
- Ie. Input is set proportional to existing error.
- Decreases response time
- Increases overshoot and undershoot
- Introduces oscillation
- Increases transient time



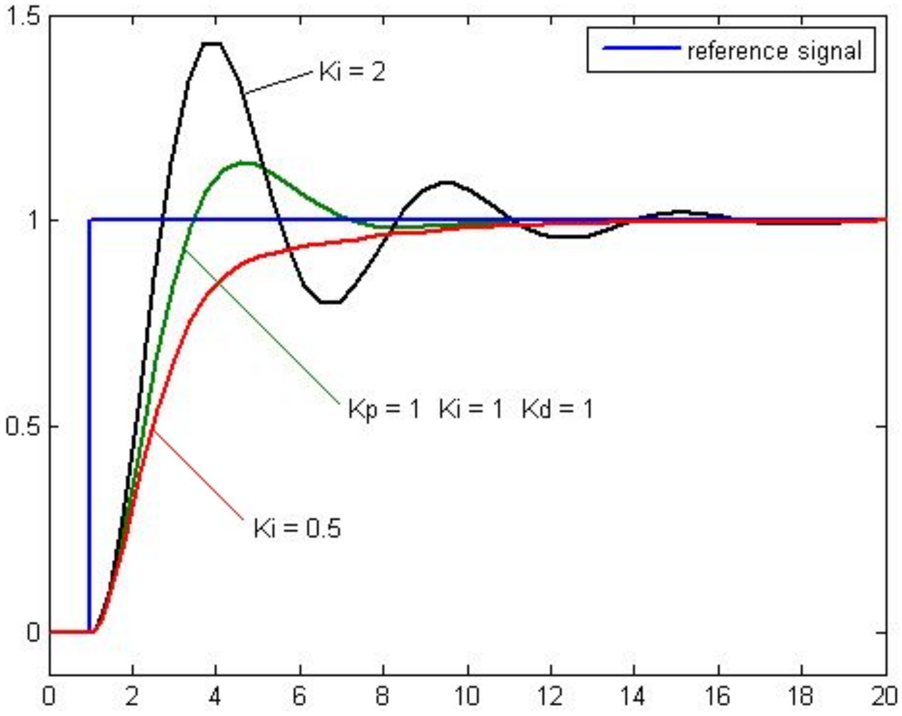
D gain (Kd)

- Doesn't concern itself with magnitude of error but only with difference in error
- Cannot bring system to a set point by itself
- Tries to bring rate of change to zero
- Thus dampening the oscillation in the system
- Increases response time



I gain (Ki)

- The integral in a PID controller is the sum of the instantaneous error over time and gives the accumulated offset that should have been corrected previously
- The accumulated error is then multiplied by the integral gain (*Ki*) and added to the controller output.
- Decreases steady state error
- May make the system unstable



Tuning PID manually

- Increase Kp till oscillation occurs at constant amplitude.
- Increase Kd till minimum overshoot is obtained ie. transient response is improved.
- Tune Ki gradually to decrease steady state error.
- System is tested by changing setpoint, subjecting it to disturbances etc.