Industrial Controller

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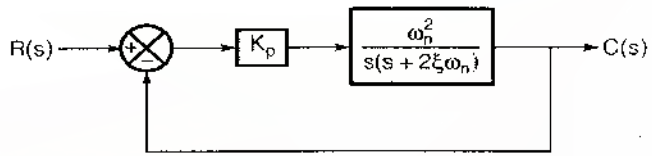
Types of Industrial Controller

1. Proportional Controller



$$\omega_n' = \omega_n\sqrt{K_p} \quad \text{and} \quad \zeta' = \frac{\zeta}{\sqrt{K_p}}$$

where, K_p = Proportional gain

Effect

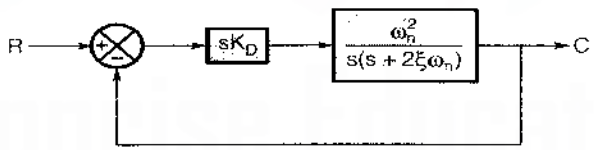
(i) Natural frequency of oscillation (ω_n) increases by $\sqrt{K_p}$.

(ii) Damping ratio (ξ) decreases by $\sqrt{K_p}$.

(iii) Peak overshoot (M_p) increases.

(iv) Steady state error reduces.

2. Derivative Controller



where, K_D = Rate constant

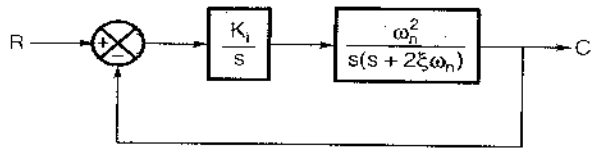
Effect

(i) Type and order of the system reduces by one.

(ii) Oscillations has died out, hence transient response improves.

(iii) Not used in isolation.

Integral Controller



where, K_i = Integral scaling

Integral controller is a memory based controller.

Effect:

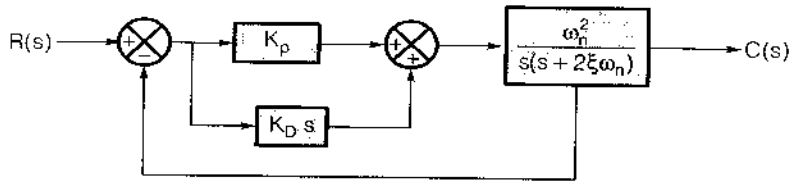
(i) It increases type and order by one.

(ii) Makes the system lesser stable.

(iii) Steady state error reduces.

(iv) It improves the steady state response.

4. P-D Controller



Effect:

(i) Transient response improves.

(ii) Damping ratio increases.

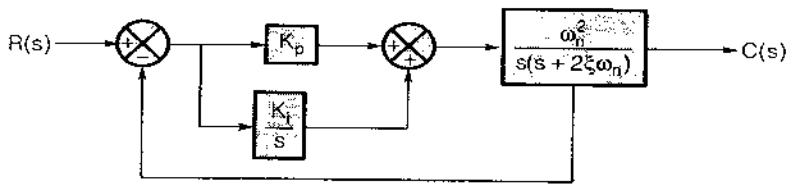
(iii) Peak overshoot decreases.

(iv) Bandwidth increases.

(v) Noise level increases.

(vi) Improves gain margin, phase margin and resonant peak.

5. P-I Controller



Effect

(i) Improves steady state response.

(ii) Improves type and order of system by one.

(iii) Noise level reduces.

(iv) Increases error constant.

(v) Bandwidth reduces.

6. PID Controller

It is similar to lead-lag compensator and band reject filter.

Effect

(i) It improves both steady state as well as transient response.

(ii) It reduces rise-time.

(iii) It increases bandwidth.

(iv) It increases stability.

(v) If eliminate steady state error between input and output.

(vi) It increases type and order of system by one.

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