Exp. No. 4

COHEN COON TUNING

Aim: To find the optimum values of $\mathbf{K_C}$, τ_I and τ_D for the given system.

Equipment Reqd.: Temperature control trainer kit.

Theory:

Write the theory of ZN tuning.

Cohen Coon tuning is an open loop method. It is considered as a better method when compared to the ZN method, because we are not going for sustained oscillations which lead to 'valve chattering'. Valve chattering may cause damage of control valves, relays etc.

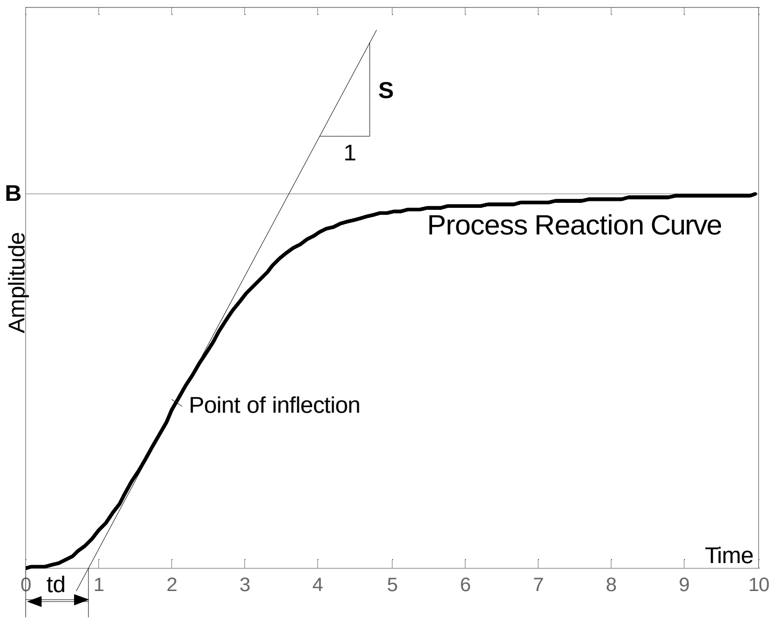
Procedure:

- Draw the experimental setup.
- Put the controller in 'manual' mode.
- Vary the controller output and allow the temperature to settle around 40° to 45°C.
- Give a step change in controller output of magnitude of, say, 10.
- Tabulate the variation of process value with time.
- Plot temp. Vs. time graph, which will give the shape of a sigmoidal curve known as the **Process Reaction Curve**. This curve gives information regarding the dynamics (behaviour) of the process.

Tabulation

Time	Temp.

Model Graph – Process Reaction Curve:



From the plot, find out the following:

Static gain, K = $\dfrac{Output(at steady state)}{Input(at steady state)} = \dfrac{B}{A}$

Time constant, $t = \dfrac{B}{S}$, where S is the slope of the sigmoidal curve at the point of inflection.

Delay, t_d = time elapsed until the system responded.

Optimum controller settings

Proportional controller

$$K_C = \frac{1}{K}\frac{t}{t_d}\left(1+\frac{t_d}{3t}\right)$$

PI controller

$$K_C = \frac{1}{K}\frac{t}{t_d}\left(0.9+\frac{t_d}{12t}\right)$$

$$t_I = t_d \frac{30+3\frac{t_d}{t}}{9+20\frac{t_d}{t}}$$

PID controller

$$K_C = \frac{1}{K}\frac{t}{t_d}\left(\frac{4}{3}+\frac{t_d}{4t}\right)$$

$$t_I = t_d \frac{32+6\frac{t_d}{t}}{13+8\frac{t_d}{t}}$$

$$t_D = t_d \frac{4}{11+2\frac{t_d}{t}}$$

Result

The given temperature control system was tuned using Cohen Coon method. For a PID controller, the optimum values of controller parameters are:

K_C =

τ_I =

τ_D =