Basic Lambda Tuning Integrating Processes

Lambda (closed loop arrest time in load response)

\[ \lambda = \lambda_f / K_i \]

Integrating Process Gain:

\[ K_i = \left| \frac{\Delta \% CV_2 / \Delta t_2 - \Delta \% CV_1 / \Delta t_1}{\Delta \% CO} \right| \]

Controller Gain:

\[ K_c = \frac{T_i}{K_i \cdot [\lambda + \theta_o]^2} \]

Controller Integral (Reset) Time:

\[ T_i = 2 \cdot \lambda + \theta_o \]

Controller Derivative (Rate) Time:

\[ T_d = \tau_s \text{ secondary lag} \]
Fastest Lambda Tuning Integrating Processes

For max load rejection set lambda equal to dead time

$$\lambda = \theta_o$$

Controller Gain:

$$K_c = \frac{3}{K_i \times 4 \times \theta_o}$$

Controller Integral (Reset) Time:

$$T_i = 3 \times \theta_o$$

Controller Derivative (Rate) Time:

$$T_d = \tau_s \text{ secondary lag}$$

Check for prevention of slow rolling oscillations:

$$K_c \times T_i = \frac{2.25}{K_i}$$
To prevent slow rolling oscillations:

\[ K_c \times T_i > \frac{2}{K_i} \]
Near Integrator Approximation (Short Cut Method)

For “Near Integrating” gain approximation use maximum ramp rate divided by change in controller output

\[ K_i = \frac{K_o}{\tau_p} = \text{Max} \left[ (\Delta\%PV / \Delta t) / \Delta\%CO \right] \]

Compute maximum ramp rate as maximum delta between input (new %PV) and output (old %PV) of dead time block divided by the block dead time and finally the change in controller output (block dead time is total loop dead time)

\[ \Delta\%PV_{\text{max}} / \theta_o \]

\[ K_i = \frac{\Delta\%PV_{\text{max}}}{\Delta\%CO} \]

Estimate open loop gain as the difference between current operating point and original operating point

\[ K_o = \frac{\%PV - \%PV_o}{\%CO - \%CO_o} \]