

## PID tuning with input constraint: application on food processing

### ABSTRACT

PID controllers are probably the most common used industrial controller. PID controller has gone through few decades and has survived successfully through the changes of technology from analogue era into digital era. Actuator saturation is among the most common and significant problem in control systems design as it may lead to instability and consequently affect the performance of the process. Normal PID controller does not take this into consideration. Normally, an anti windup compensator is added as the remedy for this constraint. For alternative, this research investigates the possibility to tune PI controller when the system is under saturation. This research will put emphasis on first order plus time delay process and an expression is developed for saturation level,  $U$  as a function of controller gain,  $c K$  with the range of  $R$  0.8-2 (ratio of time delay to time constant). Simple and accurate correlations are obtained for the saturation level ( $u$ ) and controller gain,  $K_c$ .

The proposed relations overcome this input constraint by explicitly considering the saturation level during the tuning of PI controller. Thus, saturation can be avoided and at the same time, it gives satisfactory performance. This method is named as BL tuning method and applied on spray drying process. The results showed that this BL tuning method could give satisfactory performance in controlling the process.

**Keyword:** PID controller; Tuning of PID; Input saturation