PID tuning method

1. Matlab PID Controllers
   1. Matlab provides PID controller

In Simulink – continuous library – PID controllers,

where

proportional gain

Integral gain

Differential gain

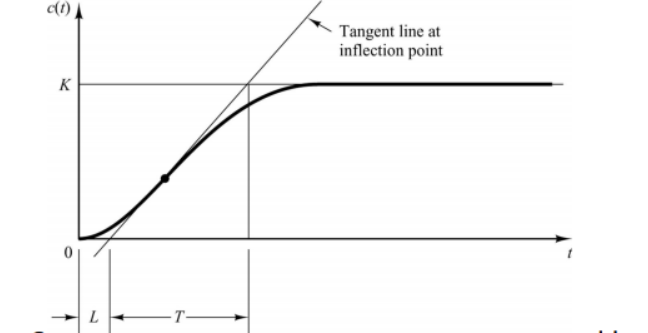
Filter gain

See ; if . In general .

1. Major characteristics of the closed-loop step response
   1. Rise Time : the tile up to 90% of the steady state
   2. Overshoot: the peak level is higher than the S.S.(S.S.)
   3. Settling time: the time for the system to converge to its S.S.
   4. Steady-State error: The difference between S.S. and the desired value
2. The effects of PID controllers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Pesponse | Rise Time | Overshoot | Settling Time | S.S. error |
|  | Decrease | Increase | NT | Decrease |
|  | Decrease | Increase | Increase | Eliminate |
|  | NT | Decrease | Decrease | NT |

1. Ziegler-Nichols Tuning Rules
   1. Based on Step Response of Plant

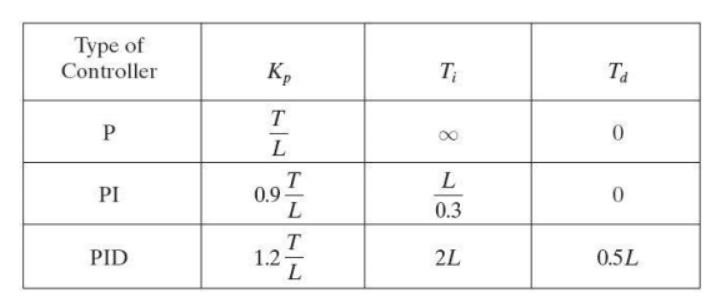


1. Two constants

Delay Time

Time constant

1. Values of Gains

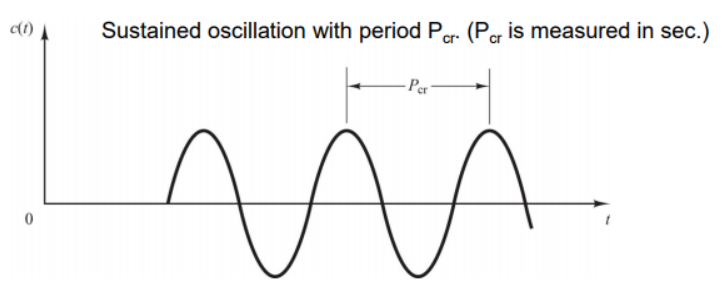


* 1. Second Method

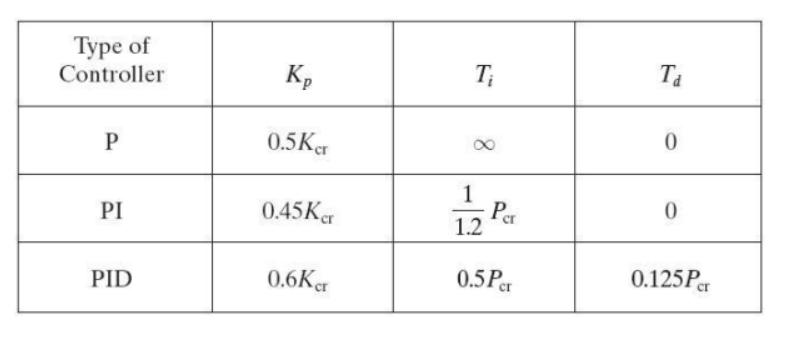
1. Two Constants

the smallest value up to system output to be oscillate

the period of the first S.S. osilation.



1. Values of Gains



* 1. The output using Ziegler-Nichols features
* With unknown plant models, the overshoot will be less than 25 % with a good settling time.

1. Matlab PID controllers

In Simulink, PID controller toolbox is provided with a good graphic output for user-friendly.

Example : a second –order system

PID\_Tuning\_1.slx with Tut\_Week\_5.m

Example: FOTD system(first order time delayed system)

Week\_5\_Time\_delay.slx with Tut\_Week\_5.m

%% comments:

Time delay linear system :

Since , which introduces infinite number of poles in the system. This leads to be difficult to analysis by the standard control linear theory.

You may verify if time delay is a little bit long, then the feedback system may be unstable!!. Check Week\_5\_Time\_delay example.