What is Deadtime ? and Why You Should Care – Second Prelude to Issue 7

By Sigifredo Nino, P. Eng.
2023 November

DEADTIME OR TRANSPORT TIME

Is the time it takes for the controlled variable to start moving in response to a change in the manipulated variable.

WHAT IS A LONG OR A SHORT DEADTIME?

Whether Deadtime is 2 s or 120 s or any other value, what is paramount is its relation with respect to the process time constant, which is measured by the Controllability Ratio (CR) = Deadtime/Lagtime

POLL RESULTS

The final results of the poll on using PID D-mode in loops with deadtime (Figure 1)

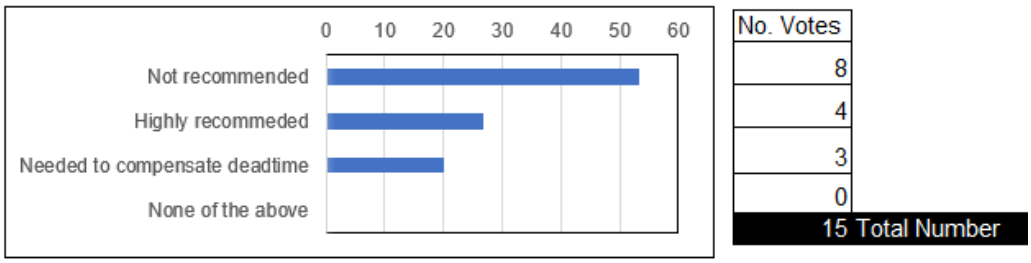

Figure 1 - When tuning PID in a control loop with deadtime, the use of Derivative mode is

COMMENTS ON THE OPTIONS

Not recommended: CR and Signal-to-Noise Ratio (SNR) are required to make this assessment.

Highly recommended: CR, the presence of a secondary lag, and SNR are required to make this assessment.

Needed to compensate deadtime: While derivative time can be helpful when there are two identifiable lags, it cannot compensate for deadtime. To determine whether the use of derivative mode enhances performance without compromising the robustness margin, one needs to calculate the CR and evaluate the SNR.

None of the above: Given that all the options above are not comprehensive, this would be the best choice.

https://summactrl.com/
https://www.linkedin.com/in/sninosumma/

AS THE CONTROLLABILITY RATIO INCREASES

the usefulness of the Derivative mode decreases. In Figure 2, I compare the response of a Deadtime or Delay-dominant to a step input disturbance. The trajectory corresponding to PID nearly overlaps that of the PI controller.

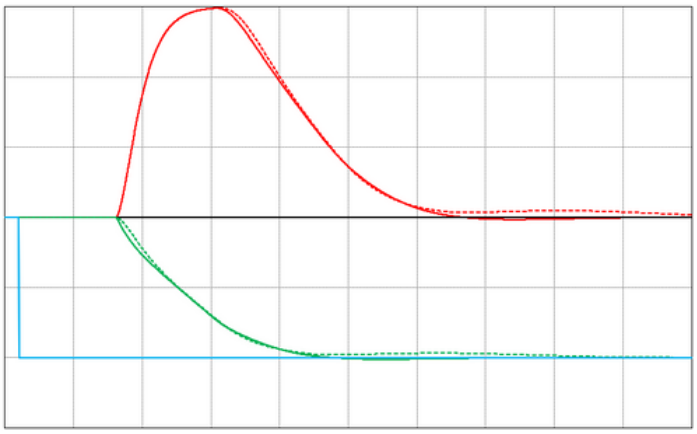

Figure 2 - PID Tuning for a deadtime dominant process.
Continuous trace: PID Controller. Dotted trace: PID Controller
Red pen: Controlled Variable. Green pen: Controller output. Cyan pen: Disturbance. Black: Setpoint

THIS PRELUDE

and the previous one introduced fundamental concepts to support the upcoming seventh Process Control Briefings: "Myths and Legends of Process Control" which is coming up in a week from now.

https://summactrl.com/

https://www.linkedin.com/in/sninosumma/