Tyreus–Luyben Tuning from Ultimate Gain and Period

PI and PID settings by the Tyreus–Luyben rules from the ultimate gain and period (relay or closed-loop test), more conservative than Ziegler–Nichols.

Method: Tyreus and Luyben (1992); Ind. Eng. Chem. Res. 31: 2625; Seborg; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Ultimate gain	4.0000	
Ultimate period	60.000	s

Calculated results

Parameter	Value	Unit
PI gain	1.2500	
PI integral time	132.00	s
PID gain	1.8182	
PID integral time	132.00	s
PID derivative time	9.5238	s

Notes for this case

• Compared with Ziegler–Nichols, Tyreus–Luyben uses about 0.7 times the gain (Ku/3.2 against Ku/2.2 for PI, Ku/2.2 against 0.6Ku for PID) and an integral time 2.6 times (PI) to 4.4 times (PID) longer: less overshoot and better robustness for process loops. Ideal (parallel) PID form.

Formula and method

$$K_c = \frac{K_u}{3.2},\ T_i = 2.2P_u\ \text{(PI)};\quad K_c = \frac{K_u}{2.2},\ T_i = 2.2P_u,\ T_d = \frac{P_u}{6.3}\ \text{(PID)}$$

Variables

K_u	Ultimate gain	-
P_u	Ultimate period	s
$K_{c,PI}$	PI gain	-
$T_{i,PI}$	PI integral time	s
$K_{c,PID}$	PID gain	-
$T_{i,PID}$	PID integral time	s
$T_{d,PID}$	PID derivative time	s

Method and standards

Tyreus–Luyben rules.

Assumptions and limits

- Self-regulating loops.

References

• Tyreus and Luyben (1992)
• Ind. Eng. Chem. Res. 31: 2625; Seborg
• Edgar
• Mellichamp and Doyle
• Process Dynamics and Control
• 4th ed. (Wiley, 2016)
• ch. 12

Report details

Report reference	FCC-294Z-SZ5V (the same inputs always give the same reference)
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/control-loops/tyreus-luyben-tuning

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.