SIMC PI Controller Tuning (Skogestad)

PI controller gain and integral time by Skogestad's SIMC rules for a first-order process with dead time, with the closed-loop time constant as the one tuning choice.

Method: S. Skogestad; Simple analytic rules for model reduction and PID controller tuning; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Process gain (change in output / change in controller output)	2.0000	
Process time constant	60.000	s
Dead time	10.000	s
Desired closed-loop time constant τ_c = θ gives fast, robust control; larger values are smoother.	10.000	s

Calculated results

Parameter	Value	Unit
Controller gain	1.5000	
Integral time	60.000	s
Proportional band 1/K_c	66.667	%
Integral gain (repeats per second × gain)	0.025000	Hz

Notes for this case

- Gain in the units of the process gain (normally % per %); integral time in seconds per repeat.

Formula and method

$$K_c = \frac{1}{K_p}\frac{\tau}{\tau_c + \theta}, \quad \tau_I = \min\left[\tau,\ 4(\tau_c + \theta)\right]$$

Variables

K_p	Process gain (change in output / change in controller output)	-
τ	Process time constant	s
θ	Dead time	s
τ_c	Desired closed-loop time constant	s
K_c	Controller gain	-
τ_I	Integral time	s
PB	Proportional band 1/K_c	-
K_c/τ_I	Integral gain (repeats per second × gain)	1/s

Method and standards

SIMC rules from the IMC design for a first-order plus dead-time model.

Assumptions and limits

- First-order plus dead-time model; PI settings only. The SIMC derivative setting for second-order (dominant lag) models is not given here.

References

- S. Skogestad
- Simple analytic rules for model reduction and PID controller tuning
- J. Process Control 13 (2003) 291

Report details

Report reference	FCC-2QF1-YM67 (the same inputs always give the same reference)
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Release checks	3 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/simc-pi-tuning

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.