

APPENDIX B

Controller Tuning by Ziegler Nichols method

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1. First, note whether the required proportional control gain is positive or negative. To do so, step the input u up (increased) a little, under manual control, to see if the resulting steady state value of the process output has also moved up (increased). If so, then the steady-state process gain is positive and the required Proportional control gain, K_c , has to be positive as well.
2. Turn the controller to P-only mode, i.e. turn both the Integral and Derivative modes off or set as zero.
3. Turn the controller gain, K_c , up slowly (more positive if K_c was decided to be so in step 1, otherwise more negative if K_c was found to be negative in step 1) and observe the output response. Note that this requires changing K_c in step increments and waiting for a steady state in the output, before another change in K_c is implemented.
4. When a value of K_c results in a sustained periodic oscillation in the output (or close to it), mark this critical value of K_c as K_u , the ultimate gain. Also, measure the period of oscillation, P_u , referred to as the ultimate period. (Hint: for the system A in the PID simulator, K_u should be around 0.7 and 0.8)
5. Using the values of the ultimate gain, K_u , and the ultimate period, P_u , Ziegler and Nichols prescribes the following values for K_c , t_I and t_D , depending on which type of controller is showed in the TableB1.

Appendix Table B1 Parameters of P, PI and PID

	P	PI	PID
K_c	$0.5K_{cu}$	$0.45K_{cu}$	$0.6K_{cu}$
τ_i	Maximum	$T_0/1.2$	$T_0/2$
K_d or τ_d	0	0	$T_0/8$