Ziegler-Nichols Method:

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.
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 desired:

Ziegler-Nichols Tuning Chart:

	K_c	t_I	t_D
P control	$K_u/2$		
PI control	$K_u/2.2$	$P_u/1.2$	
PID control	$K_u/1.7$	$P_u/2$	$P_u/8$

As an alternative to the table above, another set of tuning values have been determined by Tyreus and Luyblen for PI and PID, often called the TLC tuning rules. These values tend to reduce oscillatory effects and improves robustness.

Tyreus-Luyben Tuning Chart:

	K_c	t_I	t_D
PI control	$K_u/3.2$	$2.2\ P_u$	
PID control	$K_u/2.2$	$2.2\ P_u$	$P_u/6.3$

(Use the BACK button of your browser to return to a currently running PID tuning simulation, otherwise click here to initiate a PID tuning simulation.)

This page is maintained by Tomas B. Co (tbco@mtu.edu). Last revised 2/13/2004.

Tomas B. Co
Associate Professor
Department of Chemical Engineering
Michigan Technological University
1400 Townsend Avenue
Houghton, MI 49931-1295

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